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What Parts Wear Out First?

WE COMMEND to manufacturers of engineering and construction equipment the suggestion made by Major Fries in the letter on page 419 of this issue. Only he who has been far removed from a base of supplies can realize the feeling that comes over one when a part breaks that means a delay of anywhere from five to fifteen days in the construction of an important project. Moreover, Major Fries' case is not an isolated one. Construction engineers and contractors all over the far West and on the Coast are in a similar position. Even in the East breakage means several days' delay. "Service" is one of the slogans of all up-to-date manufacturers, and we therefore have no doubt that there will be ready response to Major Fries' suggestion.

Brick-Road Demonstration

NEXT WEEK the National Paving Brick Manufacturers' Association will meet in Terre Haute, Ind., and, after discussing various features of brick pavements, will go to Paris, Ill., to inspect the monolithic roads which have attracted so much attention. The description in this issue of the monolithic roads which are being built as part of the Vermilion County highway system is, therefore, opportune. The article goes into each detail of the work and gives information that will be welcomed by all engineers and contractors who are using or contemplate using this type of construction. The monolithic brick pavement has such intrinsic merits and has appealed so strongly to highway engineers that it is certain before long to become the exclusive method of brick-road building. For that reason the holding of a demonstration at Paris was a particularly happy thought. Much good should come of it.

Picking Water Supplies

ONCE MORE Sacramento, Cal., has been given a report on its water supply and told again that the best thing for it to do is to take the water which flows past its very doorstep. Filtered and disinfected it is the most acceptable water the consumers can get. The city is advised in a 660-page report not to flirt with alluring mountain supplies which will cost many times the more prosaic local supply. Years ago before filtration had reached anywhere near its present certainty of purifying a turbid stream, when the first New Orleans rapid-filter fiasco was still green in the mind of the sanitary engineer, Dr. Rudolph Hering recommended a ground-water supply for Sacramento. Ever since then the well-water enthusiasts in that town, forgetting that New Orleans has solved the problem of converting a turbid river water into a sparkling, bacteria-free supply, have felt positive there was an inexhaustible supply just below the surface. The scientific investigations outlined in the recent report certainly give the ground-water proposition all the credit it is entitled to, but even then the quantity available would only supply a population of 110,000. No enterprising California city of 67,000 people, as advantageously situated as Sacramento, in the heart of such an agricultural empire as the Sacramento and San Joaquin valleys, will admit that its future population will grow less rapidly than the average of the twenty-one other cities used by the engineers for comparison. By that comparison Sacramento would need the 30,000,000 gal. in 1928. The mountain supplies, the engineers found, were practically beyond the financial bonding ability of the city, and the possible incidental power development was of problematical value. The citizens of Sacramento will do well to look at the report carefully and not insist upon going far afield for a new and badly needed supply.

Inventorying Railroad Terminals

OF ALL PARTS of the physical plant of the railroad probably the terminals present the most difficult problems for the valuation engineer, and of all terminals probably the most complex are in Chicago, the world's greatest railroad center. Hence railroad valuation men should be interested in the account on page 410 of the valuation of the Rock Island terminal in that city. This is believed to be the first large terminal to be attacked in the federal valuation of the railroads, and it is interesting that the government has entrusted to the railroad the inventorying of the physical plant. And the move is believed by this journal to have been a very wise one on the part of the Division of Valuation. However competent and painstaking the government's staff might be, the railroad itself is bound to have a far better chance of getting a complete inventory by doing the work itself. The present visible plant tells only part of the story of reproduction cost, and less of original cost. If all of the hidden items are to be found at all, and all of the construction and reconstruction programs are to be traced through, it can be accomplished only by having all departments of the railroad on the alert to supply any kind of helpful information. Much of this is in the form of personal recollection. Smith, of the valuation department, who has been with the road twenty years, may not know how a certain piece of work was done twenty-five years ago, but he may remember that Burke, the supervisor, and Finnegan, the old yardmaster, were there, and by quizzing them he may be able to piece together the construction story. No outsider would know where to go for the data, and neither Burke nor Finnegan would be likely to realize that his knowledge was sought. With such complications as are found at the Forty-seventh street shops, at the Sixteenth Street crossing and in fact all over the terminal zone all of the conceivable sources of information are none too many. The Engineering Record is glad, therefore, that the Division of Valuation has seemingly appreciated the situation and has not attempted the near impossible.

A Federal Precedent

AS THESE LINES are being written New York City is facing the most sweeping strike threat ever made against a municipality in this country. In order to force the subway and elevated systems to cancel their agreements with their men and thus force the latter into the Amalgamated Association of Street and Electric Railway Employees, the Conference of Federated Unions has called upon all union labor in New York City to cease work. Should all obey, approximately three-quarters of a million workers would be affected. It is not necessary here to go into the details of the controversy. The men are clearly in the wrong. Public opinion is against them, and yet they attempt to bring the entire life of the city to a standstill. What, then, has led these men into such a false position? Undoubtedly their chiefs feel that the men will follow wherever they lead. Undoubtedly, too, the recent victory over Congress, abetted by the President, has encouraged them in their present stand. The degree of response to the call of the conference will be awaited with much interest. Four days ago the strike resolution was passed. Since then the individual unions have been debating it. It now seems that level heads are in the majority and that less than 200,000 will go out. If such be the case, it will indeed be gratifying. It will show that a majority place fair play above the dictates of misguided leaders. Nevertheless there will be inconvenience and probably some suffering. How much influence the recent federal precedent has had on the stand taken at New York it is impossible to say, but it is probable that it has not been inconsiderable.

First—A Good Engineer

A WELL-KNOWN COLLEGE PRESIDENT, commenting on the policy of this journal of urging engineers to participate more largely in civic affairs and to acquire a broad outlook on the country's economic problems, expressed the belief that there was danger of such a policy making a wrong impression on the young engineer. He might gather that outside activities were to be given attention even if his professional advancement were thereby to be made less rapid. "His first duty," the doctor said significantly, "is to be a good engineer." Needless to say, we are in hearty agreement with the doctor. No man should devote time to outside activities until he has mastered his own job. Once he has his own work well in hand, however, participation in engineering-society or civic affairs will widen his horizon and help him in the mastery of the broader engineering problems. First, however, a good engineer.

Motor Trucks—for Every Service

THE AUTOMOBILE TRUCK is no longer an experiment on construction work. It is coming into deserved favor both with contractors and with material dealers. Its economical application to all sorts of construction problems is being worked out rapidly. Within a month's time the Engineering Record has described a job where the motor truck is used successfully for a haul so long that a railroad would ordinarily be built, and another where the hauls were so short that they seemed adapted for some sort of conveyor equipment.

In the case of the Ripogenus Dam construction (described Aug. 19, page 237, and Sept. 2, page 280) it paid to build a 30-mile macadam highway, which would require only light maintenance under the small traffic expected after the completion of the dam, and to spend a considerable sum per mile during the two-year construction period to keep this road in first-class condition for the use of nine 5-ton trucks operated at fairly high speeds. The preliminary investigation of this problem indicated that the use of motor trucks would be far cheaper than railroad or team haulage, all items of cost considered, and the actual performance checked the first estimates in a most satisfactory manner.

In the case of the Detroit-Superior Bridge in Cleveland, described on page 347 of the Sept. 16 issue, trucks were used on relatively short hauls with such successful results that engineers connected with the work have expressed the opinion that the actual rate of progress could not have been maintained with any other system of transportation. Of these hauls, that with wet concrete is so short that even recently it would have been considered foolhardy to think of using a motor vehicle. Steep grades and very indifferent pavements proved no obstacles to the truck.

As the development of construction methods is chronicled it is becoming more and more evident that the motor truck has found its place as a new and powerful tool in the hands of constructors. The shortcomings of the early models, which gave rise to the prediction that the motor truck would never be able to leave the first-class city pavements, have been largely overcome. Trucks are being taken even to the bottom of large excavations, to be loaded by steam shovels, as was done at the Pennsylvania Hotel in New York, described on page 267 of the Engineering Record for Aug. 26 last.

A construction tool which has proved its utility as well as the motor truck has done is not long in coming into general favor. It is safe to say that the next few years will witness an even greater rate of increase in both the number of trucks and diversity of uses than has made the truck in the last three years the most-talked-of item of the contractor's plant.

A Convention Program on the "American Plan"

DURING the presidential campaign preceding the election of William McKinley the Republican party adopted as its slogan "The Full Dinner Pail." A perusal of the program for the twenty-third annual convention of the American Society of Municipal Improvements, to be held in Newark, N. J., next month brings the phrase to mind. The committee on arrangements has crammed the pail of its convention program full of technical food—so full that an epidemic of indigestion may result.

Perhaps it is unfair to use the dinner pail as the measure of the convention's engineering provender. The program might better be likened to the bill of fare of the "American plan" hotel—everything from soup to nuts. A scanning of the menu shows that for the morning and afternoon sessions of a single day, Oct. 11, there are scheduled for presentation 24 technical papers, discussions and committee reports, in addition to the election of officers and the selection of the next place of meeting. Below the belt line of even the stoutest trencherman there develops a feeling of unrest at such an announcement. Nor is the anxiety allayed by the knowledge that the convention is to last five days.

How much of its very lengthy convention program the society will be able to follow is of course a matter of conjecture. Certain it is that many of the papers will have to be omitted. Nothing is gained by offering a program of this sort. This criticism, let it be clearly understood, is directed, not at the quality of the papers or the ability of the authors, but at the overwhelming volume of matter which it is expected to dispose of. The whole structure is top-heavy and sure to collapse. The schedule can, of course, be adhered to if a large number of the papers are read by title only, but if that were done, the author who has spent valuable time on the preparation of some contribution for the convention would have a just grievance. Many of the papers, fortunately, have been printed and issued in advance, and it is possible that the reading-by-title method will be the course adopted. Even then the discussion must be very limited.

The American Society of Municipal Improvements, since its amalgamation with the Society for Standardizing Paving Specifications, has made specification work one of its leading activities. It certainly should be taken as one of the most important things the society tries to do. Nevertheless, the program shows that the reports of committees on standard paving specifications are scheduled for the evening session of Oct. 12 *after* seven paving papers. Assuming that all seven of these papers are delivered and that the usual practice of discussing them is followed, it will be well past midnight before the members of the association will have an opportunity to consider the committee work, which has always been represented as of such signal value. If any vote on the adoption of standard specifications is to be taken, what representative opinion can be secured at an open meeting at midnight? Is the society preparing for a fiasco similar to last year's, when a patented paving was adopted as one of its standards?

If the committee in charge of the program had matched its initiative and energy in inducing men to write papers with a proper sense of proportion the result would have been better.

Navy Department Contract Documents an Important Step Forward

THE CONTRACTOR who knows his business and is efficient is enabled to secure contracts on terms under which he can be sure of doing good work and being fairly paid for it by the new form of contract documents adopted by the Bureau of Yards and Docks of the Navy Department and used in receiving bids on Sept. 2 last for the new structural shop at the Norfolk Navy Yard. Engineers and contractors who are interested in lowering the cost of contract work through the general recognition of standards covering the important business features of such documents—a thing which has been given deserved publicity in these columns of late—cannot do better than make a study of certain provisions of the new forms which are far ahead of the usual practice.

These provisions first permit the contractor to name his own time of completion. A stipulated sum per day, based usually on the rental value of the completed work, is announced as the value to the government of the time, after the contract is let and before it is completed, during which the structure is not in service. If one man bids on a basis of 800 days for completion and another on 700 days, this sum, times 100 days, is taken from the total of the second bid before comparing its relative value to the government with that of the first bid.

Next, unit prices are called for on quantities given in the proposal schedule and provision is made for changing these quantities at the order of the government. If they are increased, the contractor is guaranteed by the contract the actual cost of the increase plus 10 per cent. If they are decreased, a deduction of the actual cost or market price at the time the bid was made, plus 10 per cent, is required. If less than $500, such changes are valued by the officer in charge; if more, by a board of not less than three government representatives.

If the work calls for it, as in the case of the structural shop, the contractor may be required to furnish an exact progress schedule and report each month how closely he is living up to it, and, if the schedule is not working out, the reason for the variation.

The provisions named are evidently meant to determine the least cost of the work under conditions most favorable to each bidder, and not the least cost under a set of conditions laid down in advance by the owner. If one contractor has a large amount of labor-saving equipment at hand, he may be able to do work much faster than firms whose plant is tied up on other jobs. He is given a legitimate means of taking full advantage of that fact in bidding. If another contractor has the brains to lay out the work so that it can be done faster than by old methods, his advantage is also assured by the method of bidding. If a third can arrange the job so that it will require more time, but can be done with far less equipment and lower overhead expense, he also is given the full benefit of his careful planning. This method of letting should also make it profitable to figure the exact cost of each part of the work, with its proper share of overhead expense, permitting an exact understanding by both parties of the financial conditions under which the construction will be carried on and making it easy to adjust the cost of changes.

The object of contract documents, as has been frequently stated, should be to eliminate guesswork and reduce the contract to a basis of exactly what result the owner wants and how the contractor can work with the owner's agents to produce it. Under such provisions as these, both parties know that the bids are submitted and the work begun on a definite plan of action, to accomplish a definite amount of work. If changes are necessary, the owner is assured, on the one hand, that the contractor will keep on with the work, and the contractor, on the other, that the owner will see that he does not lose by it.

While the questionable clause disclaiming responsibility for the plans and surveys remains, and while it is necessary in expending public money that the representatives of the government retain the right to decide all matters of payment, subject to revision only by the courts, these documents make evident in every paragraph an intention to be fair and reasonable. When statements are made in the contract documents such as, "It is mutually understood and agreed that the parties to the contract will . . . labor to mutual advantage"; that "delays caused by acts of the government will be regarded as unavoidable delays"; that, if it is necessary to tear out finished work to determine whether it meets the specifications, "the actual cost of the examination plus 10 per cent will be allowed the contractor" should the work be found to meet the requirements, the contractor will be safe in assuming that the engineers who made them will be honest in living up to them.

Rear Admiral Frederic R. Harris, the father of this change in policy, is to be congratulated for having taken a long step toward bringing into the work under his charge responsible and able contractors by offering them an honest chance to show the cash value of their superior ability. It is to be hoped that this demonstration of the practical advantage of this point of view in handling contracts will not be lost on those men who still insist that no methods but the old ones can be made to work.

Solution of the Labor Problem

LABOR, at the present minute, is a leading topic of discussion in both England and the United States. In both countries the war has brought the question to the front, though for different reasons. At the beginning of hostilities the "restriction of output" rules of the British labor unions caused a ghastly toll on the Flanders battle lines. When the facts were clearly before them the unions consented to the temporary abrogation of the restrictions. At the same time, Mr. Lloyd George organized the munitions manufacturing of the country and thousands of women were put at the lathe and the bench. To the astonishment of the English public—but not to those of its industrial leaders who knew factory conditions—these girls and women, after only a few weeks' training, showed a greater output than had their skilled-machinist predecessors. And their production has continued undiminished without any detrimental effect upon their health. What wonder, then, that England is concerning itself with the labor problem, debating as to what is to happen when the men come from the trenches to take their factory positions, and the women retire to their homes and their customary occupations!

In the United States our present labor discussions have been caused by the war, but only insofar as the latter is responsible for the munitions prosperity with which the country is afflicted. Labor knows that profits are high. It appreciates that plant owners can be forced to pay more, and it is using its organized force to secure concessions. So many are the demands for shorter hours or more pay that the country has been awakened as never before to a realization of the state in which our industries find themselves with reference to their labor problems.

In its issue of Sept. 9 the Engineering Record took occasion to point out the broader aspects of the railroad wage-increase controversy. It is interesting to note that simultaneously, in England, similar views were being placed before British labor and British industry by well-qualified authorities. Mr. Gerald Stoney, in his presidential address before the engineering section of the British Association for the Advancement of Science, and Mr. H. Gosling, president of the Trade Union Congress, and the Lord Mayor of Birmingham, Mr. Neville Chamberlain, all attacked the problem from angles proposed in this journal.

Mr. Stoney, who is well known in England as an officer of machinery-manufacturing companies, deplored the fact that British employers, as a rule, do not look after the welfare of their workmen. Proper lighting and ventilation of shops have been secured only through legislation, while conveniences, such as adequate clothes lockers, shower baths and lunching facilities, are not even now supplied, their installation not being made compulsory.

But he did not give labor a clean bill. He denounced most vehemently the agitating labor-union officials who feel that they are not adequately serving their members unless they are constantly trying to enforce new concessions, whether warranted or not.

Mr. Gosling suggested that workmen be allowed to take some part in the management of the plants in which they are engaged, while the Lord Mayor of Birmingham believed that much good would flow from admitting representatives of the workers to the counsels of the employers so that they "could see a little more of the game from the inside." In a word, Mr. Gosling and Mr. Chamberlain were desirous of developing plans that would engender that confidence which the Engineering Record said on Sept. 9 is absolutely essential if our labor problems are to be solved.

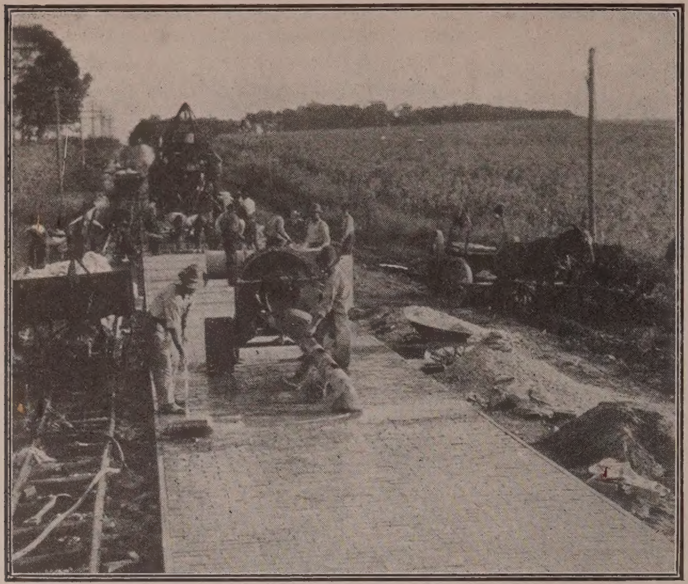
As has been heretofore stated in these columns, participation by workmen in the management of corporations is an accomplished fact in certain industries of this country. To our mind the plan should be more widely applied. In no other way will it be possible to impress upon the workman that his own prosperity depends upon that of the industry in which he is engaged. England has for years been worrying about its foreign trade. Germany has been making great inroads. Nevertheless, the British workman insisted upon the restriction of his output, not realizing that that restriction was raising the cost of production to a level seriously endangering his country's supremacy in the battle of commerce.

The present plan of procedure—of keeping the employees in ignorance of the detailed figures of the particular plant and of the economics of the whole industry—tends to excite in the employee's mind a suspicion that the owners are making tremendous profits. He sees them enjoying more of the world's goods than he has, and no one has given him an opportunity to learn whether the return is reasonable in view of the capital and ability invested.

It is but natural that employers should not, when it is first suggested, take kindly to such a plan. Everyone prefers to conduct his business as he sees fit. It is one way, however, to attack a very serious problem, and a way that offers much promise. Whether through this course, or some other, the essential is to gain the confidence and loyalty of the men, meanwhile increasing the all-around efficiency of the establishment.

The strength of labor is rapidly increasing. Its present disposition—except in some of the older and more conservative unions—is to get whatever it wants by force. If what it considers its rightful share in the earnings of industry is not granted willingly by the employer, that share will be forced from him by legislation. We are not in as bad a state to-day as England is, but unless we act quickly and effectively the intolerable conditions which have been settled on British industry by its unions will likewise obtain here.

Fortunately, the problem is possible of solution without a conflict—aye, even with increased profits to the employer. The wise man will work to that solution of the problem and not stubbornly await the conflict which otherwise is inevitable.



BRICK ARE GROUTED IMMEDIATELY AFTER ROLLING IS COMPLETED—FINISHING GROUT WHEELED FROM MIXER

In Monolithic Pavements in Vermilion County, Illinois, Brick Are Laid Directly on Concrete Base

Thin Layer of Dry Sand and Cement, Used at Paris, Illinois, Is Discarded—Construction Procedure, Modified by Experience, Permitted Good Progress to Be Made

By **HARLAN H. EDWARDS**
Urbana, Ill.; Former Inspector, Vermilion County Bond Issue Roads

In but a little more than a year a revolution has been worked in the construction of brick highways. The sand cushion is doomed to pass into highway history. Paris, Ill., became a Mecca for road engineers when it began building monolithic brick pavements. Thus a thin dry mix of cement and sand was spread on the green concrete and the bricks immediately placed. Vermilion County, Illinois, on those of its bond-issue roads being built with brick, has gone a step farther. The bricks are being laid directly on the concrete base. Twenty-five miles of this type is being laid. The construction methods now in use are, as a result of study and development, well worth the attention of highway engineers and contractors.

In order to bring the whole subject clearly before the reader a brief summary of the development of the monolithic type will be given before proceeding to a description of the design and construction of the Vermilion County roads.

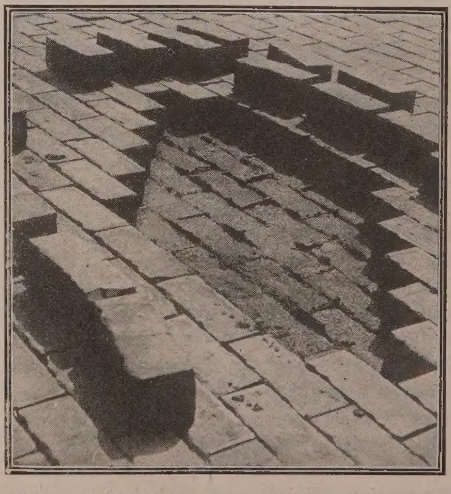
THREE STEPS IN DEVELOPMENT

There were three steps in the evolution of the true monolithic brick pavement from the old sand-cushion type. First came the substitution of the 1½-in. cement-sand bed for the old sand cushion, using just enough cement to prevent any movement of the sand under traffic. This proved unsatisfactory, for the only function of the sand was to provide a smooth surface upon which to lay the brick, and the use of such a thickness of the cement-sand mixture was too expensive.

The next step therefore came in the reduction of the thickness of the cement-sand bed. A 3/16-in. layer of a dry mix of cement and sand was laid upon the fresh concrete and the brick immediately laid and rolled. This, the first that really could be called monolithic, was the type laid at Paris, Ill., and described in detail in the Engineering Record (July 10, 1915, page 54) by W. T. Blackburn, and adopted this year as the standard brick pavement by the Illinois State Highway Department.

With this type of construction, however, it has often been the practice not to grout the brick for several days after laying. As a result, the layer of dry mix has constituted a weak plane, with consequent danger of separation along this plane, thus greatly reducing the strength of the pavement.

Finally therefore, as developed on the Vermilion County bond-issue roads, under the direction of P. C. McArdle, superintending engineer, this intermediate layer has been entirely abandoned and the brick are laid, rolled, and grouted upon the fresh concrete base after it has been struck off to the proper crown and tamped to an even, smooth and compact surface by means of templates. This makes a true monolithic pavement, with no plane at which separation may take place.



BRICK ARE BEDDED IN THE CONCRETE BY AN 800-POUND HAND ROLLER

EXPERIMENTAL SECTIONS

The first monolithic brick pavement of this type was laid near Danville, Ill., as an experiment, upon the suggestion of W. W. Marr, state highway engineer, on a road receiving heavy traffic from coal mines. It was laid in four sections, as follows: (1) A length of 36 ft., using 3-in. brick laid upon a 3-in. base, with 1:3½:6 concrete; (2) a length of 64 ft., using 4-in. brick laid longitudinally on a 2-in. base; (3) a length of 50 ft., using a 4-in. brick laid transversely on the same thickness of base, and (4) a length of 48 ft., using a 4-in. brick laid transversely on a 1-in. base, the concrete being a 1:3½ cement-sand mixture. The pavement was crowned 1½ in. in a width of 15 ft. The concrete was placed just as wet as possible, without running at the edges, struck off with a template but not tamped, and the brick laid and grouted immediately. The fourth section was placed where it received the most severe test—at the edge of a soft gravel road. In the spring when the frost is going out of the ground this gravel road is little better than a series of mudholes, from which the traffic bumps up on the pavement, while in the summer the surface of the gravel road is high above the brick and the traffic drops down upon the edge of the pavement. However, none of the work has shown the slightest sign of failure.

As a result, Stockland Township, Iroquois County, Ill., has this year voted $50,000 for the construction of 9-ft. monolithic brick roads of this type, using a 4-in. wire-cut-lug brick laid upon 1 in. of concrete on a crowned subgrade. This type was approved by the state highway engineer, Mr. Marr, and the work was let for less than $9,000 per mile, including two graded earth roads on the side. This work is now in progress.

DESIGN OF ROAD

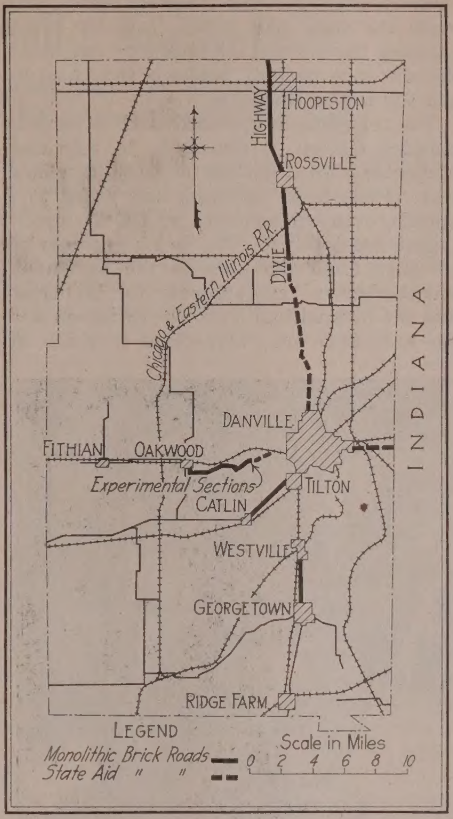
Of the system of 166 miles of hard roads being constructed by bond issue in Vermilion County, for which contracts were let last spring, about 25 miles are of monolithic brick construction. The pavement, 10 ft. wide, is constructed of 4-in. wire-cut-lug paving brick laid directly upon a fresh concrete base 4 in. thick at the sides and crowned 1 in. On each side of the pavement a strip of macadam 3 ft. wide is to be laid, and beyond this an earth shoulder 7 ft. in width, making the total width of roadway 30 ft.

Approximately 11½ miles of this type of construction are along the Dixie Highway, running from the northern boundary of the county southward, meeting a 15-mile stretch of state-aid brick road, so that the entire length of the Dixie Highway through the county will be paved with brick. The other sections of monolithic brick road are located as shown on the map. The 3¼ miles between Tilton and Catlin are completed, 3 miles between Georgetown and Westville are under construction at the present time, while 2 miles of the work near Hoopeston are nearly finished.

HANDLING MATERIALS

In the construction of the Tilton-Catlin road the pioneer work was done. All objections to this method of construction were met and overcome, and it was established as a practical, economical, and altogether successful pavement. As is often the case with new work, inefficient methods were at first employed, but soon discarded for better and cheaper ones. The same contractor, the Granite City Lime & Cement Company, also obtained the contract for the work near Hoopeston, and the construction there consequently received the benefits of the experience gained on the previous work at Catlin.

In the work near Hoopeston, the sand and stone are unloaded from cars at the construction camp by clamshell bucket and crane, and dumped into elevated bins, whence they are loaded into 1½-yd. side-dump cars for hauling to the road. The brick are unloaded with tongs and placed directly into small cars, operated on a 2-ft. gage industrial track laid along the side of the subgrade.



HEAVY LINES SHOW BRICK ROADS

Over this track the concrete materials are hauled to the road by dinkey engine and dumped upon the center of the subgrade, as shown in one of the pictures. The sand and stone are placed in alternate piles in this order: 2 cars stone, 2 cars sand, 2 cars stone, and 1 car sand. There are thus approximately 7.5 yd. of sand and 13 yd. of stone in every 100 lin. ft. In this way the materials are quickly placed so that the wheelers may operate from either side of the piles.

The steel forms are set 1000 ft. or more in advance of the mixer. Thus a very good line can be maintained with little difficulty. Six-inch steel forms are used. They have a 2-in. strip of wood bolted to the bottom, enabling them to be utilized on other types of hard roads of less thickness. Before the concrete base is placed, the faces of the forms are greased with a low-grade oil to insure a smooth surface toward the pavement and prevent the grout from sticking to and roughening the forms.

BRICK AND CEMENT

The brick are stacked 14 in each course along the side of the road, being placed there with tongs from the small cars, in such order that they may be laid in the pavement with minimum confusion.

Whenever possible the cement is handled directly from the cars to the mixer, moving the cars ahead when necessary. When, however, a clear track is needed for hauling shoulder stone and other material past the mixer to the completed pavement, the cement is unloaded on racks, as described on page 421.

The cement is furnished by the county, and in the work a 2 per cent variation from a standard calculated amount is allowed, all in excess of that amount being paid for by the contractor. In actual work the cement consumption usually runs within these limits.

CONCRETE

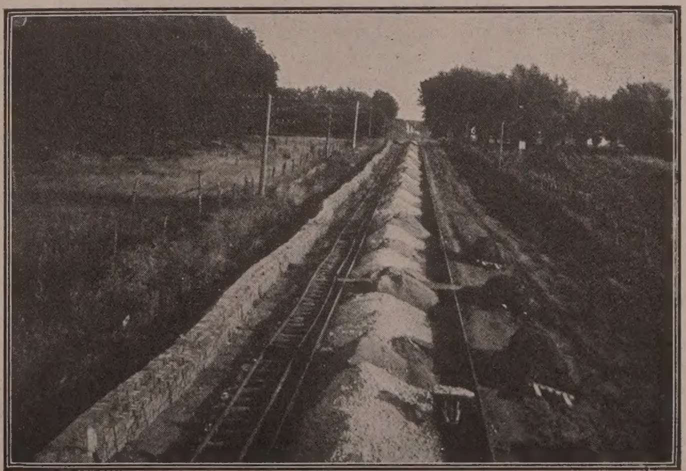
A ½-yd. Cube mixer is used. It is not run directly upon the subgrade but on 3-in. oak planks, having ⅜-in. bolts running horizontally through them to prevent their splitting and breaking away under the heavy load.

The concrete used in the base is of a 1:3½:6 mix, using 1½ to ½-in. crushed stone and sand graded from ¼ in. down. It is of a slightly quaky consistency, is dumped directly from the mixer to the dampened subgrade, spread out between the side forms and struck off to the proper thickness and crown by two templates weighted down with sandbags and drawn forward by the mixer as it moves ahead.

At first only one template was used. This was made of two 2 x 10-in. oak planks placed vertically 10 in. apart, with suitable bracing between. The lower edge of these planks was cut to a 1-in. crown and faced with a strip of iron. Rollers were fastened to each of these planks for movement along the form. This template was not satisfactory, however, for although well weighted down the concrete often became piled up in front of it as it was being pulled ahead, causing the rear face to rise and leave a high place in the concrete. This, if not removed by a second dragging of the template, would have caused a wave in the pavement.

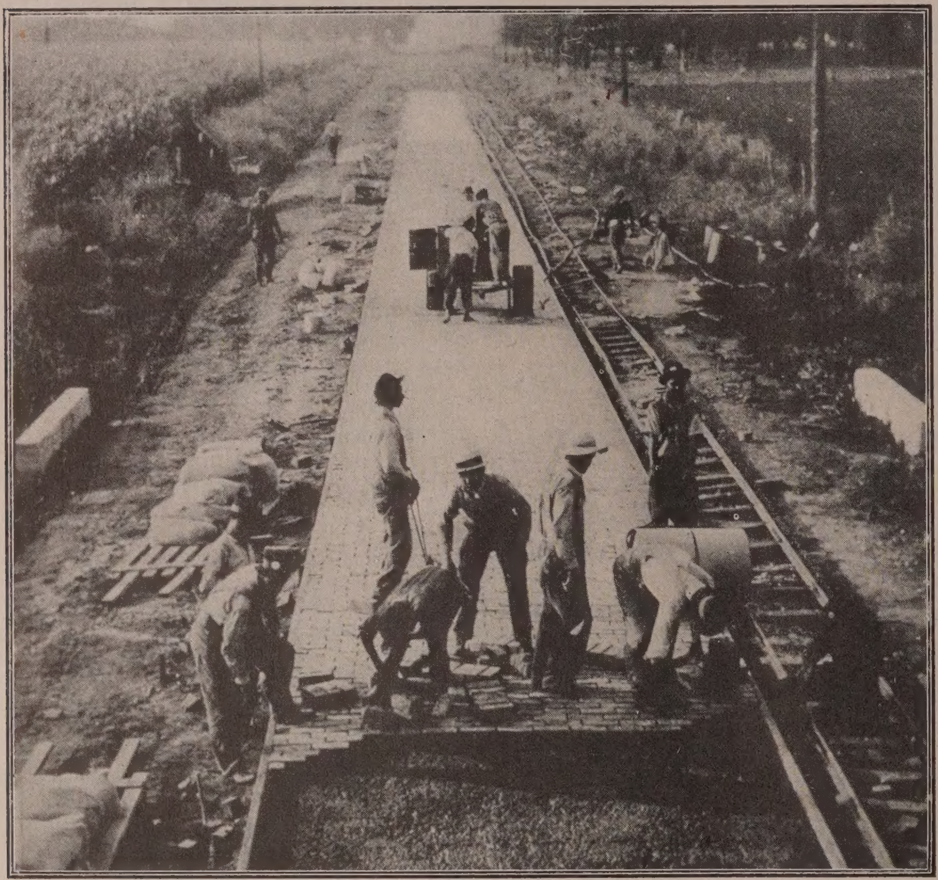
Therefore a second template, having the crowned faces 2 ft. apart, was devised.

GOOD CONCRETE SURFACE SECURED BY SLIDING AND TAMPING TEMPLATES



MATERIALS ARE NEATLY PLACED WITH THE CEMENT ON RACKS

This was supported on the forms by runners 3 ft. long, faced with iron and curved upward at the front end. This template acts as a check on the first one, taking off any high places and filling in the low ones, if any. A new steel template is now in course of preparation which will have three faces placed about 1½ ft. apart, the rear two being tilted slightly so as to smooth down and compact the concrete. This template will be pulled along the form on 7-ft. runners, projecting a foot or more in front of the front face.



ALL OPERATIONS ARE CARRIED ON WITHIN 10 FEET OF THE MIXER

Runners are used on the templates instead of rollers in order to eliminate any irregularities in the surface or at the joints of the forms. Rollers drop into any depressions, leaving the concrete with the same contour as the surface of the form. They also concentrate the weight of the template, tending to make irregularities in the forms, especially at the joints, while the runner distributes this weight over a large area. Instead of having the same crown as the finished pavement, the faces of this new template will be crowned 1½ in. to allow for more compacting of the concrete and for a greater depth of embedment of the brick, while still maintaining a final crown of 1 in.

After the template cuts off the concrete to the desired crown the concrete is tamped with a crowned tamping template. This template is made of two 2 x 10-in. planks placed vertically, between which is placed a 1 x 6-in. strip extending diagonally upward and outward from each end, and containing at the upper end a handle for moving the template up and down. The bottom edges of these planks are crowned 1¼ in., similar to the dragging template, and have a 1 x 10-in. strip nailed to them as a tamping face. The upper part of the planks extends out over the edge of the form, while the lower part is cut in to the width between the forms, the depth of cut being the distance desired between the concrete and the top of the form.

The template is operated with a vertical tamping motion by two men. A thin coat of mortar is thus flushed to the surface, and upon it the brick are laid, and rolled to a smooth, even surface with an 800-lb. water-ballast hand roller. The brick are carried in tongs from the piles to the pavement, and stacked in regular order for laying so that the lugs will all be in one direction and the best face up. Inspection is made at this time, and all rough, broken or cracked brick are either turned over or put out of the pavement.

GROUTING

The brick are grouted immediately after the rolling is completed. The grout is made of equal parts of cement and sand, mixed to a uniform consistency in a small Marsh-Capron grout mixer. The sand is of such size that it all will pass a No. 12 screen, and if necessary is screened in the yard. It is sacked and placed along the roadway with an equal amount of cement, so that no time is lost in measuring. This also maintains a uniform mix, so that with a constant amount of water, grout of the same consistency is obtained.

The first coat, of the consistency of thin cream, is run on from the mixer through a spout having a grating on the lower end to catch any lumps that may have escaped the operator's attention. It is broomed into the joints and allowed to set. The second coat is put on within an hour, but is carried back in wheelbarrows instead of running the mixer back over the pavement already grouted. The second coat is also of the consistency of thin cream, and is worked thoroughly into the joints with a squeegee. The material along the edges is made somewhat thinner by sprinkling the sides slightly before applying the second coat. This insures a thorough filling along the edges of the pavement. A small amount of grout is left on the pavement at this time to provide for settlement. When it has partially stiffened, the pavement is gone over a second time with the squeegee, filling all joints and cleaning the grout off flush with the surface of the brick. All operations are carried on within 100 ft. of the mixer.

When the grout has hardened sufficiently, the pavement is covered with 2 in. of earth and kept wet for ten days. Traffic is kept off for at least three weeks. The pavement is then cleaned off, the shoulders shaped up and the 3-ft. macadam or gravel shoulders placed and compacted by rolling along the side of the pavement.

ORGANIZATION OF GANG

In the usual organization for the carrying on of this work 32 men are required. They are distributed as follows:

Ahead of the mixer are 1 form setter, 5 wheelers, 3 shovelers, and 1 cement man. At the mixer are the operator and the fireman. Behind the mixer there are two men spreading concrete and one for carrying forward the boards upon which the mixer is run, and for tamping the concrete. In the paving gang there are 1 brick setter, 3 stackers, 1 starter (who helps with the tamping), 1 batter, 5 carriers, 1 culler, and 1 roller. Three men usually suffice to grout the pavement. Finally, one man is needed to keep the pavement wet down and to pull the forms. With this organization and a good mixer 700 or 800 ft. of pavement is a good day's work.

There are no expansion joints in the pavement, care being taken to bond each day's work to that previously laid. In the work so far completed contraction cracks have occurred straight across the pavement at intervals of from 60 to 125 ft., depending on the temperature at which the pavement was laid.

With this type of construction the most important part of the work, so far as obtaining a smooth surface is concerned, is at the mixer and the templates. Intelligent rolling of the brick is a necessity, but if the concrete is not of uniform consistency almost no amount of work short of taking up the brick and reshaping the concrete will make the pavement smooth. Too great emphasis cannot be placed upon this detail of the work. The proper operation of the mixer to insure a uniform consistency of concrete is imperative.

Auto in Boston Water Department Averages 700 Miles a Month

Two hundred trips a month, each averaging 3½ miles, is the record of the emergency repair car used by the Boston water department. The car, which can carry fourteen men and a large supply of equipment, has traveled about 37,000 miles since it was built, in 1911. Twice in five years it has been overhauled, and it is said that during the first 17,000 miles of service its only expense was for fuel, oil and tires. No choice of routes is made in answering calls, despite which the car's maintenance cost is comparatively low. The chassis is a White, with a 40-hp. motor.

Filtered-Water Supply for Sacramento Recommended in 660-Page Report

River Water Considered Most Satisfactory and Economical of Many Sources Investigated—Novel Head-House Design Described

FILTERED Sacramento River water is the best and most economical supply for the city of Sacramento. That is the finding of Charles Gilman Hyde and George H. Wilhelm, consulting engineers, and Frank C. Miller, city engineer—the three engineers who have made a 660-page report on every feasible supply. In addition to the filtered supply, pumped from the river, ground water and gravity supplies from the distant mountains were studied in minute detail. The comparisons were made on the basis of quality, available yield, dependability, cost of construction, annual cost and total cost.

RIVER WATER BEST

All of the sources and projects are deemed of equal merit with respect to bacteria content, for costs to free them from disease-producing bacteria were included. Turbidity would be something in the unfiltered mountain water and micro-organisms must be cared for in the storage basins. Tastes and odors may also be developed. The river water filtered is considered the most attractive. Color troubles do not enter into the problem. Hardness of the mountain streams and rivers is nearly the same—40 and 50 parts per million—but the ground water has a hardness of 85. As to quantity, the ground-water supply is limited to a precarious supply of 30,000,000 gal. daily. The two mountain sources in the Sierra Nevada Mountains each can be developed to 100,000,000 gal. daily, but the river supply for all practical purposes is unlimited.

Costs per 1,000,000 gal. daily to develop the various supplies are as follows: $18,300 for the river, $43,800 for the ground water, $139,200 for the mountain supply from American River and $153,100 for the other proposed mountain supply from the Mokelumne River below Electra. These figures are based on a development of about 70,000,000 gal. daily for all but the ground water, which is limited, as noted above, to 30,000,000 gal. No extraordinary profits, the engineers found, may be anticipated by investing in power-plant equipment to utilize the head in the mountain projects. Annual costs also favor the river supply. In initial stages of the development for 20,000,000 gal. the relative annual costs are $25.40, $25.64, $88.40 and $91.90 for the river, ground water and two mountain supplies. For 30,000,000 gal. the relative costs are $19.40, $18.55, $53.70 and $55.90 respectively.

RAPID FILTERS CHOSEN

Although a number of combinations of processes were studied, the most economical and the one recommended is as follows:

Preliminary subsidence in a grit basin to remove the coarsest sediment which would settle rapidly and freely, due to its own weight and character, is to be followed by a longer period of subsidence (employing a coagulant when necessary) to remove the great bulk of the finer suspended matter and some of the bacteria. Final purification is to be effected by rapid sand filters of the usual type, employing a secondary dose of coagulant applied in special basins containing a sufficient storage merely to permit the chemical reaction to take place, and thus insure a well-defined flocculation of the water. These filters should be designed for an average rate of operation not greater than 125,000,000 gal. per acre per day. Considerable latitude in actual rates of operation in practice will be permitted by this type of filter. Disinfection of the effluent is provided for by a suitable chemical, probably liquid chlorine or chlorine gas generated electrolytically.

UPWARD-PRESSURE DIFFICULTIES

The material in which the excavation for the proposed basins is to be made is a fairly sandy clay and sand in which the ground-water level probably fluctuates with changes in elevation of the water in the river. The bottoms of the basins, as proposed, will probably rest in a thick stratum of fairly clean sand. If any basin should be emptied when the ground-water elevation in the surrounding material is relatively high, the upward thrust against the floor lining might be sufficient, unless corrective measures were taken, to cause this to be upheaved and destroyed. To meet this condition it is proposed to cover the entire bottom of the excavation for the basins with a layer of gravel averaging at least 6 in. in thickness. Beneath this layer cross-trenches in both directions, and from 25 to 30 ft. apart, would be excavated. These trenches, perhaps 1 ft. deep and 2 ft. wide, would also be filled with gravel and would serve as collectors from which the ground water would be delivered into any basin, while emptying and empty, through numerous relief valves placed in the bottom. It has been assumed that as many as 160 of these valves might be necessary in the system of basins. By such means the water level should be lowered as rapidly and completely as necessary and thus obviate any dangerous upward thrust.

WATERPROOF LINING OF FLOORS

Above the gravel layer it is suggested that a layer of oil-clay, gravel, and fine broken stone puddle, 6 in. in thickness, be placed. This puddle, if properly proportioned, mixed and laid, should constitute a thoroughly waterproof lining for the basin floors. It is believed that the asphaltic oil-mixed puddle will be greatly superior to the ordinary water-mixed puddle because it will neither crack in the cold nor dry out and crack under the action of the sunlight and hot, dry atmosphere before the protecting floor of concrete is placed. Moreover, so far as the available evidence goes, it appears that it would be durable and would not disintegrate under the action of water. If, however, the asphaltic oil should disintegrate with the passage of time, it seems certain that the clay, broken stone and sand would constitute a suitable waterproofing. Test borings indicate that suitable clay and sand will be obtained from the various excavations for the plant. Tentatively a floor of concrete laid in squares with suitable waterproof joints has been assumed. Further studies may show that it will be better to provide a reinforced-concrete floor tied into the side walls and laid continuously without joints. Such a floor might make it unnecessary to provide a puddle lining.

HEAD-HOUSE NOVEL

The head-house will serve a fourfold purpose in connection with the proposed works, as follows: (1) Beneath the ground it will contain a large drainage sump having an effective capacity of perhaps 290,000 gal. and serving as a receiver of washwater from the filters, of subsoil drainage waters from the ground about the works and, when necessary, of the deposits washed from the coagulating and sedimentation basins in the process of cleaning; (2) the ground floor, at the same elevation as the operating floor of the filters, will contain a main corridor leading to the filter operating floor and a coagulant receiving and hoisting room, together with rooms for the superintendent of filtration, the filter attendants, etc.; (3) a second floor will be devoted to the necessary apparatus for the mixing, measurement and application of all coagulant and disinfectant or sterilizing solutions; (4) the uppermost portion will contain a great steel storage tank containing fully 200,000 gal. of water for use in washing the filters.

The washwater tank, as proposed, will contain a sufficient volume of water to wash effectively two and perhaps three filters. The tank will be supplied from the force main leading from the high-lift, high-duty pumping engines to the city distribution system through a pipe so arranged that the rate of delivery and the volume discharged into the tank may be very effectively controlled. With proper regulation the load on the main pumping engines will not be caused to fluctuate violently on account of rapid changes in elevation of water in the tank. It may readily be demonstrated that it is very much cheaper and better to supply this elevated tank with filtered and sterilized water by means of the main high-duty pumping equipment than through any auxiliary equipment which would ordinarily be provided for such a purpose. The washwater tank proposed is elevated considerably higher above the filters than those which have usually been constructed in connection with filtration works built elsewhere.

RATE WASHWATER WILL BE USED

With the single-wash process of cleaning filters the rate at which the washwater will be used will be fully 7.5 times the rate of yield from the filters represented by their nominal capacity and nearly 5.5 times the rate of yield represented by their ordinary maximum capacity. The rate of use of water in washing one filter in a ten-unit plant would therefore be about 75 per cent of the rate of yield from the entire plant when operating at its nominal capacity of 125,000,000 gal. per acre per day, and 55 per cent of the rate of yield at what may be assumed to be an ordinary maximum capacity of 175,000,000 gal. per acre per day. It is therefore obvious that a generous storage of washwater is necessary if this is to be supplied through the main pumping engines and if the rate of draft upon these engines is to be kept relatively low and maintained as uniform as possible.

In connection with this project, it is proposed to construct immediately ten filter units having a nominal daily capacity of 30,000,000 gal., representing a rate of

125,000,000 gal. per acre per day, and a maximum capacity of perhaps 40,000,000 to 45,000,000 gal. per day. Each unit would have an effective filtering or sand surface area of about 1050 sq. ft., or 0.024 acre. The filters would be built in two batteries of five units each, separated by a pipe gallery 20 ft. in width. They will rest upon and be supported by portions of the roofs of the filtered-water basins. Each unit will be built of reinforced concrete as a monolith, complete with sides, bottom and roof.

PERFORATED PIPE UNDERDRAIN

It is proposed to equip the filters with a special type of underdrainage system which, in the experience of one of the engineers, has been demonstrated to be cheaper and more efficient than almost any other. The underdrainage system must be designed to collect the filtered water in the ordinary operation of the plant and to distribute and diffuse the filtered washwater—and air, if used—in the process of cleaning the filtering media. This underdrainage system must therefore connect both with the filter effluent piping, regulating and controlling equipment and with the air-wash and water-wash system.

Air washing is not proposed in connection with the Sacramento filtration works, but it is suggested that the design be such that it may be installed at any future time if its use should appear necessary or desirable. The underdrainage system within each filter unit would be divided into four equal parts, each of which would be provided with a special cast-iron manifold and a system of properly and uniformly spaced pipes with uniformly spaced perforations or orifices of proper size in the under side along the axes thereof. Such a manifold and piping system, if properly designed and installed, would be equally serviceable in filtered-water collection as in washwater and air distribution and diffusion. Each quarter of the filter would be so connected with the main effluent and washwater-supply piping that it will yield its proportional part of the filtered-water supply from the entire unit, or receive its proper proportion of the supply of air and water in washing. The filters will be designed to respond automatically to the requirements of the city and thus maintain the filtered-water basins continuously nearly full so that a supply of water in storage sufficient for all ordinary emergencies will be always available.

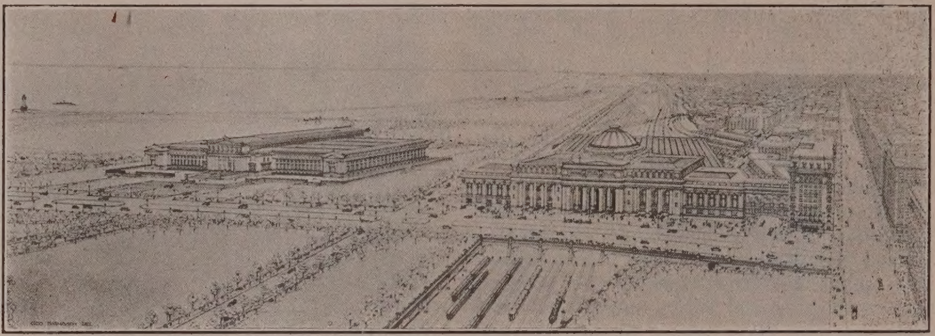
GRAVEL AROUND UNDERDRAINAGE SYSTEM

The underdrainage piping system would be surrounded and entirely covered by a layer about 6 in. in depth of coarse gravel whose particles will possibly vary from 1.5 to 2.5 in. in size. Above these, three other layers of successively finer material, making a total underdrainage depth of 15 in., might be employed. A sand bed 30 in. deep, having an effective size of about 0.35 mm. and a uniformity coefficient between 1.3 and 1.5, would probably represent a satisfactory and very efficient filtering medium. Above the sand surface a maximum water depth of 6 ft. is tentatively proposed. This depth is fully 2 ft. greater than that ordinarily employed with this type of filter, but there are very good reasons, states the report, for believing that difficulty with patent claims may be completely avoided by such design, and that from other standpoints, such as freedom from air entrainment, unusually satisfactory results in operation will thereby be insured.

Illinois Central Presents Terminal Plans

New Station in Chicago Would Cost $30,000,000, and Electrification As Much More—Other Roads Would Have to Come In

WHAT the Illinois Central Railroad would like to build at Twelfth Street, Chicago, was shown Sept. 20 to the Chicago City Railway Terminal Commission in eleven plans. A. S. Baldwin, chief engineer, spokesman for the company, frankly stated that the enormous development, which John F. Wallace of the commission roughly estimated would cost $30,000,000, and as much more for complete electrification, could not be justified unless other roads not now using the Union and North Western stations came into the terminal. No such agreements have been made.


PROPOSED STATION FACES A WIDENED TWELFTH STREET—MICHIGAN AVENUE ON THE RIGHT, THE NEW FIELD MUSEUM ON THE LEFT

The scheme involves a head-house 250 ft. deep and 700 ft. wide fronting on Twelfth Street. The monumental Ionic style conforms to that of the Field Museum being erected to the east at a cost of $8,000,000. The first floor of the station, subsurface, will be for suburban traffic; the next higher for mail, baggage, express and the like, and the third for a general waiting room. Still higher will be three floors for offices. In the waiting room will be a mezzanine floor overlooking the lake and the Field Museum. To the west of the station a large hotel of twelve or more stories was presented on the plans. This is at the corner of Michigan Boulevard and Twelfth Street east, on property now owned by the Illinois Central. A bridge across Indiana Avenue, which would be extended north to Grant Park, connects the station with the hotel. The property north of Twelfth Street extended east is to be added to Grant Park.

To increase the facilities of access to the entrance of this proposed station the plans show that the Twelfth Street car line shall be extended to the east boundary of the Illinois Central property. The tracks of the line are to be depressed below the surface, starting about Wabash Avenue and going under Michigan Avenue. At the same time the plans show that Twelfth Street Boulevard is to be extended east from its present terminus at about the viaduct level now maintained west of State Street, across the various railroad tracks of the Chicago & Western Indiana and Rock Island groups of roads.

With the property fully developed there will be twenty-four stub-end tracks leading into the station at the level of the general waiting room. Perhaps as many more will be provided on the subsurface level for suburban traffic.

According to the track layout and building sites indicated, the freight facilities will be on the ground level to the south of the station, and nearest the lake and the promised recreation development of the South Park Commission. The separation of grades will start about Twenty-fourth Street, the long-distance trains ascending and the suburban trains descending.

To get other roads into the station it is proposed to have an entrance to the track yards at Eighteenth Street. The Illinois Central proposes to buy a strip 200 ft. wide, immediately north of Eighteenth Street, and extend it west to the south branch of the river that it may intercept all lines that now lead into other railway stations east of the river.

"A complete development of the property," said Mr. Baldwin, "practically necessitates the electrification of the suburban service. Electrification of it will not be necessary with a partial development, because the suburban trains can be brought in on the present level."

Location of Water Gates Made Easy by Tying to Permanent Structures

How the location of water gates in Boston is made easy was told by George H. Finneran, general foreman of water service of that city, in his paper on the emergency repair gang presented at the recent convention of the New England Waterworks Association. A distance mark is stenciled on a fence, pole, or building directly opposite the gate, if possible, telling the number of feet from the mark out to the gate. If the mark cannot be placed opposite the gate it gives the distance between the mark and a point opposite the gate. A stenciled arrow shows the direction, right or left of the mark, that one must measure to get the opposite point. In other words, the mark gives the base and perpendicular of a right-angle triangle, the apex of which is the gate. These marks are black on white ground, or the reverse, depending on the color of the background. The object is to make them as conspicuous as possible, especially at night. When the ground is covered with snow these marks are invaluable. In squares and intersections where there are many gates a sign is erected on a post with the distances for all the gates tied from the one point—the post. This makes unnecessary a number of marks on the corners and sides of the squares or intersections, and concentrates the information at one point. The sign is not unsightly. It has gold letters on a dark-blue ground, and is similar in outline and general appearance to the street-name signs.

Adopt Rules of Procedure for New York Board

Building Regulations to Be Controlled by Resolutions of Board of Standards and Appeals —Meetings Open to the Public

UNUSUALLY complete rules of procedure have been adopted by the New York City Board of Standards and Appeals, which has final control over all orders and requirements relating to building construction in this city and the interpretation of the code and the new zoning restrictions passed on July 25. Meetings are held weekly in the Municipal Building on Thursday afternoons, which are open to the public, and any person can be heard on a matter before the board at a given meeting by handing his name beforehand to the secretary. Those in opposition to any proposed action are to be heard first, to insure orderly procedure. The work is reported weekly in a bulletin, in which all announcements are made. The rules regarding resolutions give evidence of such careful consideration that they are reprinted here in full.

The board of appeals after Oct. 1 will consist of Rudolph P. Miller, chairman; H. C. Baird, William Crawford, A. R. Kirkus, A. J. Boulton, L. C. Holden and Fire Chief John Kenlon. The board of standards and appeals consists of the foregoing, together with the fire commissioner and the superintendents of buildings of each of the five boroughs. Daniel Sullivan is secretary.

RULES GOVERNING RESOLUTIONS

The following are the rules governing resolutions:

"Every act of the board or the board of appeals shall be by resolution.

"Every member or his authorized representative present at a meeting shall vote on all resolutions unless excused from voting by the chairman, but such excuse shall only be made on the ground of personal interest. The vote of each member or his authorized representative upon every resolution shall be recorded unless absent or excused from voting, in which case such fact shall be noted.

"No resolution of the board of appeals granting an appeal from any order, requirement, decision or determination of a superintendent of buildings or the fire commissioner under Section 719 of the charter shall be passed, unless the appeal has been taken within twenty days of the date of the issuance of such order, requirement, decision or determination, and the officer from whom the appeal is taken has been notified as prescribed. Five affirmative votes of the board of appeals shall be necessary for the adoption of such a resolution.

"No resolution of the board adopting a rule or regulation under subdivisions 2 or 3 of Section 718a of the charter shall be passed until a hearing, after at least ten days' notice by publication in the bulletin of the board, has been held on such proposed rule or regulation. Eight affirmative votes of the board shall be necessary for the adoption of such a resolution.

"No resolution of the board granting a petition for a variation of the labor law or of any rule adopted thereunder, affecting the construction or alteration of buildings, exits therefrom, the installation of fixtures and apparatus as authorized by Section 718a, subdivision 4 of the charter, shall be passed, until a hearing, after at least ten days' notice, has been held on such petition. Eight affirmative votes of the board shall be necessary for the adoption of such a resolution.

"Every resolution of the board suggesting changes or amendments to the law under subdivision 5, Section 718a of the charter, shall require at least eight affirmative votes for its adoption.

"Every resolution not otherwise provided for, ordinary motions, or decisions on rules of order shall require in the case of the board of standards and appeals seven affirmative votes, and in the case of the board of appeals four affirmative votes.

"No amendment of any resolution shall be passed on the same date that it is offered, except that verbal changes, which do not alter the substance of the resolution, may be passed by unanimous consent of the members present.

"No resolution amending or repealing a rule or approval, previously adopted or existing, shall be passed until notice of such an amendment or repeal has been given and a hearing on the same has been held as required for the adoption of such a rule or approval. The same number of affirmative votes shall be necessary for the adoption of a resolution amending or repealing any rule or approval previously adopted or existing as is required for the adoption of a new rule or approval.

"Matters not on the calendar and not requiring notice may be considered at any meeting by unanimous consent of those present entitled to vote."

Office of Public Roads Prescribes Rules for Federal-Aid Appropriations

Will Control Disbursement of $75,000,000—Close Government Supervision Insured at Every Step—Rules Now in Force

THE DISBURSEMENT of the federal-aid road funds, aggregating in five years $75,000,000, was entrusted by Congress to the Secretary of Agriculture. He, in turn, has turned over the administration of the law to the Office of Public Roads and Rural Engineering. In order to draw up rules for the handling of details a meeting was held in Washington some time ago at which the various features of the procedure were discussed with state highway officials. As a result there has been formulated a set of rules which has been approved by the Secretary and is now in force.

The rules set forth the government's contact with each step of the procedure. Close supervision is provided from the first proposal of a project until its completion. The government will know at all times just how and for what its money is being spent.

The following paragraphs give the main features of the rules. The legal phraseology has been modified and minor steps omitted:

INFORMATION FOR THE SECRETARY

Before an agreement is made upon any road or roads to be constructed in a state, or the character and method of construction, upon request of the Secretary there shall be furnished to him, by or on behalf of the state, general information as to its laws affecting roads and the authority of the state and local officials in reference to the construction and maintenance of roads; as to schemes for future construction; and as to provisions made, or to be made, for constructing and maintaining roads upon which it is contemplated that the expenditure of money appropriated by or under the Act will be proposed.

The information furnished shall be sufficient to enable the Secretary to determine whether it is likely that the money apportioned to the state will be expended, and the roads constructed will be properly maintained, in accordance with the terms of the Act.

PROJECT STATEMENTS

A project statement shall contain all information necessary to enable the Secretary to ascertain (*a*) whether the project conforms to the requirements of the Act; (*b*) whether adequate funds, or their equivalent, are or will be available by or on behalf of the state for construction; (*c*) what purpose the project will serve and how it correlates with the other highway work of the state; (*d*) the administrative control of, and responsibility for, the project; (*e*) the practicability and economy of the project from an engineering and construction standpoint; (*f*) the adequacy of the plans and provisions for proper maintenance of roads; and (*g*) the approximate amount of federal aid desired. With each statement there shall be submitted for the approval of the Secretary copies of the form of contract, together with all documents referred to therein or made part thereof, and of the contractor's bond which it is proposed to use on the project.

Projects will be deemed preferred, and recommended for approval, by the state highway department in the order in which the project statements are submitted, unless it be otherwise specified in writing; but the Secretary may, in his discretion, consider the projects in a different order.

Each project statement shall be accompanied by a sketch map, showing the location of the proposed project and all main contiguous transportation features.

Suitable samples of materials suggested for use in the construction shall be submitted to the Office of Public Roads, whenever requested by it.

Where any part of the cost of a project is to be furnished by a county or other local subdivision or subdivisions of a state, the project statement shall be accompanied by certified copy of each resolution or order, if any, of the appropriate local officials respecting the funds which are or will be made available, or respecting the supervision of the construction of the road and of the expenditure of the money provided or to be provided for paying such cost.

SURVEYS, PLANS, SPECIFICATIONS, AND ESTIMATES

Surveys and plans shall show necessary data, in connection with the specifications and estimates, to enable the Secretary to ascertain and pass upon location, grades, drainage, bridges, other structures, special and unusual features, the work to be performed, and the probable cost thereof.

Specifications shall set forth the proposed method of construction, type of construction, materials to be used, and other essentials, in such detail as to afford complete knowledge of all steps to be taken in the construction of the project.

The estimate for each project shall show the estimated quantity and cost of each item of construction in detail and, separately, the 10 per cent fund, and shall not include any expense of advertising.

RIGHTS-OF-WAY AND GRADE CROSSINGS

Rights of way necessary for any project shall be provided, and any incidental damages to adjoining property due to construction work paid, by or on behalf of the state, and the expense thereof shall not be included in the estimate or paid in any part by the federal government.

Grade crossings shall be avoided where practicable. The estimated cost of eliminating a grade crossing shall not include any amount the state, county or other civil subdivision is entitled to receive, as reimbursement or payment from the owner of a public utility, on account of such elimination.

No part of the expense of making surveys, plans, specifications or estimates, by the state prior to the beginning of construction, shall be included in the estimate or paid by the federal government.

CONTRACTS

No part of the federal money set aside on account of any project shall be paid until it has been shown to the satisfaction of the Secretary that adequate means, either by advertising or otherwise, were employed, prior to the beginning of construction, to insure the economical and practical expenditure of such money.

Bids shall be in such form that the unit prices will be clearly shown.

Copy of the tabulated bid prices, showing the unit prices and the totals of each bid for every project, shall be furnished promptly to the Office of Public Roads.

In advance of the acceptance of any bid, sufficient notice of the time and place the contract is to be awarded shall be given to the Office of Public Roads to enable it, if it so desires, to have a representative present. When a bid has been accepted prompt notice thereof shall be given to the Office of Public Roads.

If the contract be awarded to any other than the lowest responsible bidder, the federal government shall not pay more than its pro rata share of the lowest responsible bid, unless it be satisfactorily shown that it was advantageous to the work to accept the higher bid.

CONSTRUCTION WORK AND LABOR

Unless otherwise stipulated in writing, materials for the construction of any project shall, prior to use, be tested for conformity with specifications, according to methods approved by the Office of Public Roads.

Unless otherwise specifically stipulated in the project agreement, bridges, viaducts and under-passes shall have clear width of roadway of not less than 16 ft., and clear head room of not less than 14 ft. for a width of 8 ft. at the center.

No part of the money apportioned under the Act shall be used, directly or indirectly, to pay, or to reimburse a state, county or local subdivision for the payment of any premium or royalty on any patented or proprietary material, specification, process, or type of construction, unless purchased or obtained on open actual competitive bidding at the same or a less cost than unpatented articles or methods equally suitable for the same purpose.

Written notice of commencement and completion of construction work on any project shall be given promptly by the state highway department to the Office of Public Roads.

Reports of progress, showing force employed and work done, shall be furnished whenever requested by the Secretary or his authorized representative.

RECORDS AND COST KEEPING

A separate account for each project shall be so kept by the state highway department as to enable the Secretary to ascertain at any time the expenditures on and the liabilities against the project and, separately, the condition of the 10 per cent fund.

Such other records of contract and force account work, and of inspections and tests by the state, shall be kept by the state highway department as will enable the Secretary at any time to determine the condition of the construction and maintenance of, and the cost to the state and the federal government of, the construction work and labor done on any project.

The accounts and records, together with all supporting documents, shall be open, at all times, to the inspection of the Secretary, or his authorized representative, and copies thereof shall be furnished when requested.

Certified copies of payrolls on force account work and of all vouchers for other expenditures shall be furnished, whenever requested by the Secretary or his authorized representative.

Whenever requested by the Secretary or his authorized representative, unit costs on any project shall be kept, on forms furnished by the Office of Public Roads.

PAYMENTS

Vouchers, in the form provided by the Secretary and certified as therein prescribed, showing amounts expended on any project and amount claimed to be due from the federal government on account thereof, shall be submitted by the state highway department to the Office of Public Roads, either after completion of construction of the project or, if the Secretary has determined to make payments as the construction progresses, at intervals of not less than one month.

Solve Silt Problem on Yuma Irrigation Project

Reclamation Engineer Tells of Troubles at Laguna Dam and Describes Methods of Silt Removal from Ditches

SINCE the siphon under the Colorado River at Yuma was completed to furnish water to the Gila River and the Indian Reservation the 65,000,000 acre-feet of water discharged has contained enough silt to cover 1,000,000 acres 1 ft. deep. Approximately one-one-hundredth part of this water was diverted into the canal system of the Yuma project. L. M. Lawson, project manager, in a recent issue of the *Reclamation Record*, states that the sluicing operations at the Laguna dam are so successful that the heavy sand, which represents 25 per cent of the sediment, is all removed and does not find its way into the canal system. Sand has no fertilizing qualities, so the sluicing operations in this respect are considered wholly satisfactory.

In addition to the removal of the sand, a certain varying quantity of the silt in suspension is also removed. With increased wasteway facilities and with the increase in acreage under cultivation, which in the past four years has averaged 5000 acres a year, the difficulty of handling the problem of silt will be greatly diminished. The plan of removing the accumulations of silt, which in the past has consisted in the use of teams and has involved a shutdown of from forty to sixty days in the winter months, is giving way to a program of machine cleaning, using dragline excavators, which will be in operation throughout the entire year, will not interfere with water deliveries, and which will remove the silt at one-third the cost of team excavation.

Had the same amount of silt and sand as the river water contained gone into the canals and onto the land, it would have amounted to 12,000 acre-feet of submerged mud, but an estimate based on the cross-section of the canals and their carrying capacity indicates only 600 acre-feet. It is not deemed necessary to remove this entirely because only one-fourth of the area of the project land is in cultivation. To this limited area using water can be attributed the cause of the quantity of silt now present. As the canals are constructed for the entire area, their cross-section has decreased materially by the discharge of the small amount of water possible because of the limited area being served. In the larger canals, where greater quantities of water can be discharged than were actually required for irrigation, the decrease in area has not taken place to such a large extent, but in the laterals of the project, where only a small percentage of the acreage that they were designed to serve was in cultivation, and where the full capacity of the canal could not be discharged, considerable silting has occurred.

Water Company Asks Advance Payment for Metered Water

As an opening wedge to the disagreeable task of sending notices of reminder that water bills must be paid when due, the Terre Haute Water Company puts into the first paragraph of a letter sent to all consumers the suggestion that many customers dislike to be bothered with bills every month and have therefore asked if advance payments cannot be made. The letter goes on to suggest a system whereby this may be done and receipted bills sent each month, thus saving the time necessary to make out checks. Not until the last part of the fifth paragraph is the "sting" reached in the words, "In the future, where bills are delinquent, the supply will not be continued. Where water is shut off on account of bills not being paid, there is an additional charge of $1." The last paragraph reverts to the prepayment plan again thus: "We have failed to find any other adequate way of enforcing payment from the very small percentage of our customers, who apparently want special favors. We dislike to use this method—it is not pleasant for us, nor for the women folks, who are the ones most inconvenienced. Possibly the new plan of advanced payments may solve the problem—we sincerely trust it will."

CUTOFF-WALL CONSTRUCTION HANDLED BY CRANE AND MIXER MOUNTED ON TOWER

Careful Construction to Make Large Dam for Youngstown, Ohio, Watertight

Well-Rolled Fill, Cutoff Walls to Rock, Riprap Grouted by Pouring and Use of Local Concrete Materials Mark Construction of Large Storage Basin

THE DAM now being completed in Milton township to form a 12,000,000,000-gal. storage basin for the water supply of Youngstown, Ohio, is being built with special attention to securing a permanent, watertight structure of the earthfill-concrete-spillway type. The 200,000-yd. clay-and-gravel fill for the earth portion of the dam was rolled in 6-in. layers, the surface being wet down in advance of each layer. Rock fissures beneath the cutoff wall which protects this fill were drilled into and grouted through 3-in. pipes embedded in the concrete, after the wall was finished, thus saving several months' delay in completing the earthfill. A satisfactory method of securing a riprap slope paving laid up in cement mortar by grouting the riprap, which is first laid dry, saving much time over laying the riprap in mortar by hand, has been developed. An unusual plant, including five towers and two mixers, which made large use of sand, gravel, crushed rock and plum stone obtained on the site, has been used to advantage in constructing the 50,000-yd. concrete spillway section.

FEATURES OF DEVELOPMENT

The dam, which will flood 1700 acres, forming a reservoir 6½ miles long and 1½ miles wide at its widest point, will conserve the flow of the Mahoning River. This stream, which is joined below the reservoir by two others of about the same size, is relied on for at least one-third of the water supply of Youngstown, Ohio, which is expected eventually to reach a consumption of 100,000,000 gal. daily. The present total consumption is about 15,000,000 gal. daily. It is expected that the normal annual discharge of the Mahoning River will be sufficient to keep the reservoir approximately full under the heaviest daily draft that will be made for some time to come. Youngstown takes its water from the river at a pumping station just above the city, at its filtration plant, and the construction of an aqueduct from the new reservoir is not contemplated at present. It acts, therefore, merely as a storage basin.

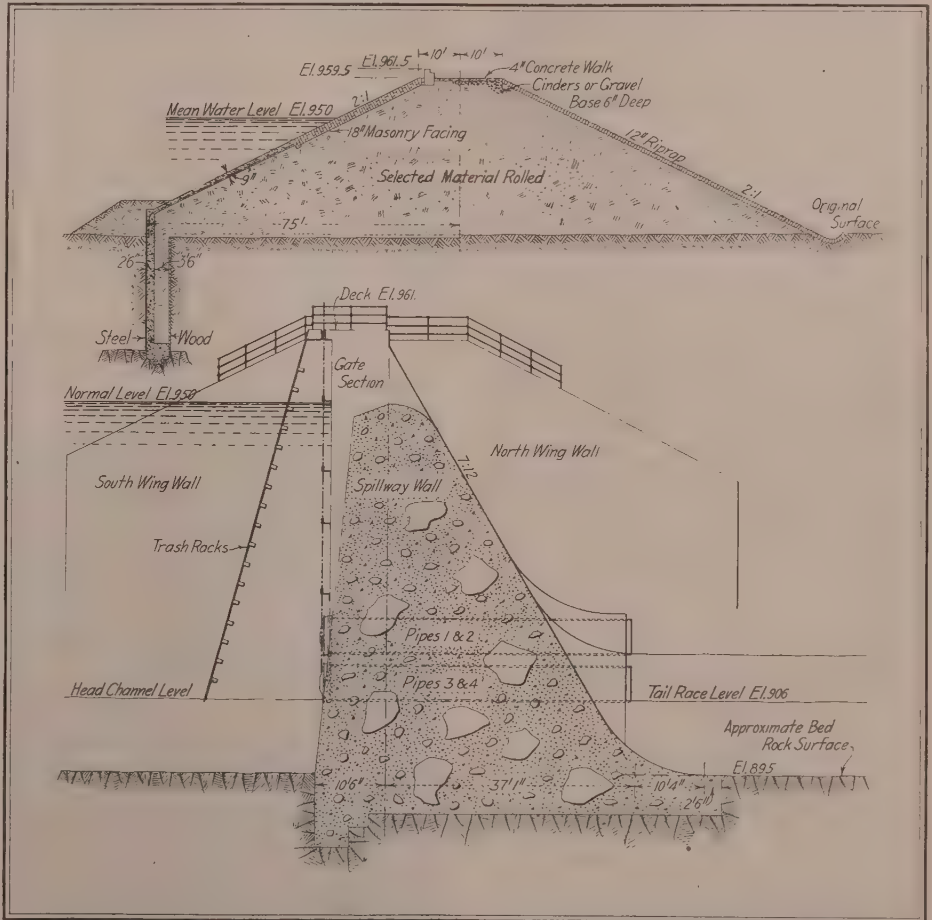
The spillway section of the dam is 638 ft. long, with four sluiceway openings of 20 sq. ft. each located at its west end. The overall length of the dam is 2840 ft., the parapet along the earth section being at El. 961.5, the spillway at El. 9500 and the present river level at about El. 905. The sandstone which underlies the dam site outcrops at the west end and dips to a depth of about 25 ft. below the river level at the east end of the spillway. The project has required the relocation of about 8 miles of road, the clearing of about 500 acres of land and the construction of four concrete and steel bridges. One of these bridges, 1436 ft. long, contains 1274 ft. of concrete viaduct, with a 19-ft. clear roadway, the remaining length consisting of a 160-ft. steel span on concrete piers. Another is of similar construction with a steel structure 800 ft. long and a total length of 1280 ft., with a 23-ft. clear roadway.

EARTH DAM BUILT WITH TEAMS AND DUMP CARS

The earthfill section of the dam consists largely of clay, with some gravel. Most of the material was excavated adjacent to the fill inside the reservoir basin by two small steam shovels. At first, only teams and wagons were used in placing it, the greater part of the embankment being placed in this way. Heavy rains during the second construction season, however, made this method difficult and small dump cars on narrow-gage track, which was shifted from side to side as filling progressed, were substituted. The cars were hauled by teams, a snatch team being used to pull six-car trains up from the pit. It was not difficult to keep the thickness of the layers down to 6 in. with this method, and as a 10-ton road roller was used to compact the fill, the method is said to have proved very satisfactory.

CUTOFF WALL BUILT IN NARROW TRENCH

Early in the work a 6-ft. wide trench, sheeted on the upstream side with steel and on the downstream side with wood, was started in which to build the cutoff wall at the upstream toe of the earthfill. The steel sheeting was driven by an ordinary pile-driver, and the wood sheeting was placed as the excavation progressed. This work was taken care of by hand digging and a locomotive crane on a track parallel to the up-



EARTH DAM AND SPILLWAY MADE TIGHT WITH KEYWAYS, CUTOFF WALLS AND GROUTING

CRANES ABOVE AND BELOW DAM AND EXTENSIVE SPOUTING PLANT BUILT SPILLWAY MASONRY WITH MATERIALS BORROWED AT SITE

stream side of the trench. The material was dumped upstream from this track and used for the toe of the extra bank fill upstream from the cutoff. As soon as rock was reached, it was found that grouting underneath the wall to close occasional vertical seams and the horizontal seams between layers of the sandstone would be necessary. To avoid delaying the construction of the wall, which would have held up the placing of the fill, 3-in. pipe was embedded in the concrete at 5-ft. intervals, through which grout holes were drilled at leisure by a single Calyx shot drill. Alternate holes were drilled and grouted, and afterward intermediate holes were drilled as test holes. Very little grout was taken by the secondary holes, and it is believed that all of the seams were successfully closed by grouting in this way.

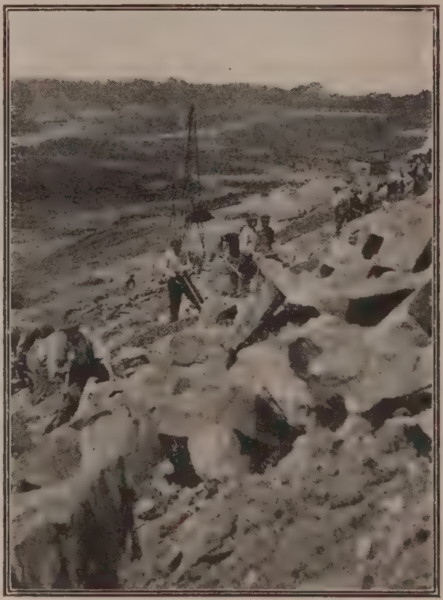
The wall itself, 2½ ft. thick, was poured against the steel sheeting in the upstream side of the 6-ft. trench, and the remainder was puddled. The rock lay from 30 to 36 ft. below the surface of the ground, and the trench was carried down as far as it was practicable to excavate the work by hand with hammer and bars. A key was then cut into the solid rock, the bottom of the trench completely filled with concrete to a point about 3 ft. above bottom of steel sheeting and the wall carried up with a thickness of 2½ ft. from this point. A mixer set in a traveling tower downstream from the trench concreted this wall. Materials were delivered to it by team from the sand and gravel pits. The way in which sand and gravel were wheeled from the earthfill out to the tower over a timber bridge is shown in one of the photographs. This plant was, of course, able to spout concrete directly to place in the wall. On the completion of a section of concrete, the forms, bracing and wood sheeting were taken out and the trench was backfilled with puddled clay and gravel.

CONCRETE AND RIPRAP SLOPE PAVING

In the top of the cutoff wall was embedded the lower edge of the first sheets of expanded-metal reinforcing for the 9-in. concrete paving which covers the lower half of the upstream face of the earth dam. This paving was not started until the fill was practically complete. It was spouted from a small mixer carried along the top of the fill. A fairly wet concrete, it was found, would stand, if properly manipulated, on the 2:1 slope. The slabs were built in three layers; concrete was first spread over the bank, then expanded metal was placed, then a fairly wet layer, and last a drier mix. The slabs were cast 21 ft. wide, and expansion joints at the sides and bottom were painted with Barrett's paving pitch. Where this paving joined the abutments of the spillway section, a 12 x 18-in. shelf was made in the top of the abutment wing wall, and also a keyway by nailing a 2 x 4-in. strip inside the form, this shelf and keyway being filled by the concrete of the slab when the latter was poured. This precaution and that of extending the slab reinforcing into the cutoff wall are expected to prevent any leakage at these joints, and also to provide against settlement.

STONE LAID UP DRY BEFORE GROUTING

As soon as enough of the concrete paving was placed, the earth slope above it was leveled off to a depth of 18 in. below the finished slope surface and work started on laying the rubble masonry extending from the paving to the concrete coping at the top of the fill. The stone for this purpose was brought from a quarry 2 miles east of the dam on long platform cars, in two-car trains hauled by a single team. At first the usual method of laying the stone up in cement mortar by hand was tried. It was thought, however, that considerable time could be saved by laying the stone up dry in advance and then grouting it. This method produces equal, if not superior, results to the old way.



STONE PAVING LAID DRY AND GROUTED

In advance of laying up the dry riprap, the 18-in. face at right angles to the slope above the concrete paving was cut under about 6 in. and plastered with cement mortar. The riprap was laid dry clear to the top of the slope, this work being carried considerably in advance of the grouting. For the latter, a small mortar mixer, gasoline driven, was carried along the top of the fill, being supplied with materials by team. A sectional wood chute from this mixer was laid on the slope to within a few feet of the bottom of the riprap. Mortar was poured down this chute, deflected with a shovel, prevented from piling up at one point by spreading it with wire brooms, and allowed to fill all the joints for a distance of 4 or 5 ft. above the concrete slab. This work was carried 20 or 30 ft. in advance before the upper part of the slope was grouted. A section would then be taken off the bottom of the chute and several feet above the first grouted strip filled. In the next operation another section of chute was taken out and the grouting carried to the top of the bank. The chute was moved by hand over the slope in circles, and the mixer was moved about 30 ft. at a time. A grout of one part cement to three of sand, mixed to flow readily, was used. This grout would disappear from the surface and travel through the joints along the clay slope to a distance of from 6 to 10 ft. from the point where it was first discharged. The work was closely inspected to make sure that the grout was of a consistency to flow properly and that all the joints were filled. It was found that with this method small voids caused by shrinkage occurred about 2 in. below the surface, but that the lower 15 or 16 in. of the stone was thoroughly filled with the gravel.

The top of the earthfill will be paved with a concrete walk having a parapet on the upstream side. The downstream slope will be covered with a compact pavement of 12-in. riprap. It is thought that in this way the dam will be protected against damage from burrowing animals and that provision will be made against the cost of maintaining the 2 to 1 earth slope.

CRANES EXCAVATE SPILLWAY FOUNDATION

Two locomotive cranes, one above and one below the spillway section, on trestles parallel to it, handled the excavation for the foundation and placed the plum stone in the masonry. The earth excavated was piled above and below the dam, but most of it was carried away by one or two floods which occurred during construction. The stone excavated was largely saved, and used, together with stone from a quarry opened for obtaining crushed rock at a point above the dam, for plum stone.

The crane on the up-stream side was also used to construct the cutoff wall, which was carried well into the hill facing the east end of the dam.

One concrete plant was located near the middle of the spillway section on the downstream side. The aggregate used was half crushed rock and half gravel with sandstone boulders. The plant was supplied from the quarry mentioned, from a large pit stripped below the dam and from a small one above it. Over the ¾-yd. mixer were erected bins filled by a clamshell derrick. This derrick took washed sand and gravel and crushed stone from storage piles, to which material was carried by cars from the quarry, and by gravity from the washing and screening plant and from the crusher plant. The screening plant was supplied by a bucket elevator drawing materials from a small pit into which cars from the gravel pit were dumped.

FILL, CHIEFLY CLAY, PLACED IN 6-INCH LAYERS AND COMPACTED WITH 10-TON ROLLER

A second mixer, used for the west end of the spillway section and the short cutoff wall back of the west abutment, was set on top of the hill at the west end of the dam a short distance from the county road. This mixer was supplied with materials brought in by rail to Pritchard, a mile and a half west of the site. A narrow-gage track was laid at the side of the highway from this station, and material was hauled in trains of dump cars by team.

CONCRETE SPOUTED 450 FEET

An extensive Lakewood spouting system, consisting of two steel towers, one at each mixer, and three wooden tail towers, was used. All five towers were about 150 ft. high, and the chutes were suspended from cables strung between these towers and other cables clamped to the first set and extending along the crest of the dam. Concrete was spouted a maximum distance of 450 ft.

The concrete was carried up in sections small enough to allow a depth of several feet to be poured before the cement began to set. The plum stones, weighing from a few hundred pounds to a ton, were washed off with a hose and when necessary cleaned with steel brush brooms, after which they were dropped into the fluid concrete. Smaller stones were embedded by hand in the top of each lift to form a bond with the next section. The sandstone boulders, or plum stones, formed about one-third of the spillway concrete. All vertical sections were keyed to each other in the usual manner. Expansion joints were spaced from 40 to 60 ft. apart. No cracks have developed in any of the sections.

PROJECT NEARING COMPLETION

The earth dam and spillway were started at approximately the same time in the fall of 1913. The latter is now complete except for the upper part of the central concrete section, which has been left open temporarily to take care of flood waters. The earth-fill is finished, as is the paving on its upstream slope. The road reconstruction necessary has been completed, including the four bridges mentioned, so that it will be possible to fill the reservoir this fall. The reservoir will be cleared and burned over, but no earth stripping will be done.

The project has been designed by F. M. Lillie, city engineer, and has been carried on under his general direction. William M. McCartney, supervising engineer for the city, has been in charge of the construction of the reservoir. The contractors for the dam, which will cost about $575,000, are Adovasio & Company of Youngstown. The entire project is estimated to cost about $1,250,000.

San Francisco-Oakland Bridge Plans

An error was made in the description of the cantilever type of design for the proposed San Francisco-Oakland bridge, submitted by Charles Evan Fowler of Seattle in the news note on page 275 of the issue of Aug. 26. The three 2000-ft. cantilever spans in this design are between Telegraph Hill and Goat Island, and the 2950-ft. approach would connect Goat Island with Oakland. A more complete description of this design will be found in the issue of Oct. 10, 1914, page 398, with editorial comment, or in J. A. L. Waddell's new book, "Bridge Engineering." Associated with Mr. Fowler in developing this design were Gustav Lindenthal, Frank C. Osborn, Edwin Duryea, Jr., and Prof. Charles B. Wing. A typographical error in the note made the estimated cost of the Wilbur J. Watson design $23,000,900; the correct figure is $23,900,000.

How Horsepower Is Burned Up at Arrowrock Dam

Batteries of Gates Are Placed at Different Levels—Smooth Passages Under High "Spouting Velocities" Wear Well

AT THE HEIGHT of the irrigation season enough energy in the discharge of the Arrowrock dam must be destroyed every second to lift a 250-ton locomotive 100 ft. in the air. The tale of how the water is regulated and foot-pounds are smashed up into British thermal units at this high dam is one of many sleepless nights and days of hard work in the design, construction and installation of the various valves and devices now in operation. J. M. Gaylord, in the August *Reclamation Record,* tells the story of how it has been done at Arrowrock.

FIVE PASSAGES THROUGH DAM

At the level of the river bed five passages lead straight through the solid concrete of the dam. These passages are for draining the reservoir, should this become necessary, and were also used to carry the flow of the river when the diversion tunnel was closed upon completion of the dam. In each passage is a massive sliding gate of steel and cast iron, operated by a powerful oil cylinder. An operating gallery just above these outlet passages runs parallel with the face of the dam and contains the operating mechanism for the sluice gates. These gates are intended for operation only when the water is less than 60 ft. deep over the outlet, but the oil cylinders are sufficiently powerful to operate them under 100-ft. head should emergency require. It is not desirable to operate these gates partly open except under very low head, as this kind of service subjects the mechanism to much greater stresses than wide-open discharge when the leaf is completely withdrawn from the flowing stream. Neither is this type of gate adapted to use under high heads even when wide open. When the water reaches a depth of 100 ft. it has a very high "spouting velocity" and when released will attain a speed of nearly 60 miles per hour. These terrific velocities must be handled with due respect, and an entirely different type of valve has been developed for this service.

TEN OUTLETS REGULATE FLOW

Five feet above the river bed a battery of ten outlets is placed, this time circular in form and controlled by Ensign balanced valves, described in the Engineering Record of July 11, 1914, page 53. These are the lower main outlets for the discharge of irrigation water and are designed for continuous regulating duty under high heads up to 150 ft. if necessary. These are, by courtesy, called needle valves, although the analogy is rather remote, the so-called "needle" being a small trinket of cast iron and bronze 6 ft. in diameter and weighing in the neighborhood of 10 tons. The valves themselves are placed on the upstream face of the dam and are entirely submerged. By an ingenious yet very simple arrangement of the needle and cylinder in which it moves each valve is made to constitute its own power plant, and the operation which in the case of the sluicing gates requires an oil-pump motor and piping is performed by simply opening or closing a small control valve in the second operating gallery. The water surrounding the valves is the operating force and the balanced valves follow the operation of the control valve, opening when it opens and closing when the control valve closes.

Smooth Passages Do Not Wear

The water enters the valve radially and is discharged as a smooth circular jet in the center of the outlet passage. Every precaution has been taken to make the water passage below the valves perfectly smooth and straight so as to offer the least possible resistance to the stream. To these straight smooth passages and the correct shape of the needles is largely due the success of these outlets, which have operated throughout two seasons and are still in perfect condition. The tar is not even worn off the castings of the valves.

At this level there are, in addition to the irrigation outlets, three openings designed to deliver water to a power plant should one be constructed at a later date.

At an elevation 150 ft. above the lowest outlets is located the upper battery of ten balanced valves for the regulation of the irrigation flow and to assist in the control of floods. Each of these twenty valves will discharge up to 800 cu. ft. of water per second, and when these jets, each 5 ft. in diameter, are in operation, the results are indeed spectacular. The water falls clear of the dam and its energy is absorbed harmlessly in the pool below.

Rolling-Dam Spillways Work

Last, though not least in importance of the control devices, is the regulating spillway crest, which is said to be actually endowed with almost human intelligence. It consists of six closed steel tanks, 62 ft. long, with a cross-section like a sector of a circle being hinged along the narrow side just below the concrete crest of the spillway (see Engineering Record of Aug. 2, 1913, page 125). They can be depressed into chambers in the spillway to allow a flood to pass or raised to any desired height to maintain the desired water level. When set for automatic operation, the moving crests will, without attention, fall step by step to allow a flood to pass and gradually rise again to the desired elevation as the flood subsides, thus allowing the flood to pass as quickly as is safe, yet storing the desired amount of water as soon as the flow falls to a safe valve. These crests are the watchdogs of the reservoir and protect the dam and river below against sudden floods. They have been tested out experimentally and their operation demonstrated to be remarkably satisfactory.

The various devices for the control of water at Arrowrock are operating with perfect satisfaction. The flow can be regulated from 1 sec.-ft. to 10,000 sec.-ft. with ease and safety, and floods of 40,000 sec.-ft. can be handled by the spillways, although no such flood has yet passed the dam. The success of these devices is no doubt due in large measure to their efficiency and simplicity, which are the true criteria of engineering excellence of design.

Road Engineers Needed

Inquiries made by the National Automobile Chamber of Commerce to highway commissions show that there is a lack of well-trained highway engineers. Steps have been taken in a movement to encourage the universities and colleges to provide special courses in highway engineering to meet the rapidly growing demand for engineers in this field.

Valuation of Rock Island Terminal Zone in Chicago Presents Many Special Problems

What Is Believed to Be First Inventory of Large Terminal in Connection with Federal Valuation Is Being Made by the Railroad

By C. W. STARK
Associate Editor, Engineering Record

When one thinks of the tremendous task imposed upon the Interstate Commerce Commission by the federal Valuation Act, one is likely to have in mind the 250,000 miles of railroads stretching over the entire country, and to overlook the complicated conditions at the large railroad centers. The Division of Valuation, beginning with some of the smaller roads, away from the great centers, has not yet got deeply into the terminal tangles, even though a large part of the mileage of some of the leading railroad systems has now been covered by the field parties. An inkling of the special problems to be encountered in terminal zones is found in the inventorying of the Rock Island terminal district at Chicago, now nearly completed. In the editorial pages will be found comment on the decision of the Division of Valuation, believed by the writer to be a wise one, to let the railroad make the inventory. Suffice it to say here that the usual procedure has been reversed, so that the railroad company is doing the work and the government is merely providing the pilot or inspector.

What the Terminal Zone Comprises

The part of the Rock Island system designated as the Chicago terminal comprises everything owned or used by the company between the La Salle Street Station and Joliet, 43 miles west on the main line. In addition to the 43 miles of main line, there is a suburban line 7 miles long, known as the Dummy Line, leaving the main line at Gresham and coming back at Blue Island, and a line known as the South Chicago Branch, which is used by the Baltimore & Ohio and the Pere Marquette as an entrance to Chicago, and by the Rock Island for interchange freight business. This branch is also 7 miles long, and extends from Gresham east to South Chicago. In addition to this are the great industrial centers throughout the South Chicago manufacturing district, which are tapped by this line.

The La Salle Street terminal station, one of the six principal passenger terminals of Chicago, is owned jointly by the Rock Island and the New York Central. The two roads own and operate jointly the main tracks from the terminal to Englewood, 6.7 miles, the New York, Chicago & St. Louis being a tenant of the New York Central. In this stretch there is also a profusion of side tracks, freight yards and houses, shops and bridges, some under the sole ownership of one or the other of the two companies, others under various divisions of ownership in no way discernible on the ground.

Parts of the South Chicago line are owned and operated jointly with the Chicago & Western Indiana. In addition, as previously stated, the Baltimore & Ohio and the Pere Marquette are tenants of this line and about a mile of the Dummy Line. At Joliet, too, there are joint facilities with other roads.

In the last twenty years or so the La Salle Street terminal has been built, the joint line to Englewood has been elevated in nine successive programs, more track elevation has been and is being done on the main line beyond Englewood, track elevation has been done at South Chicago and Joliet and a new joint station for five roads has been built at Joliet.

Special Problems Every Mile

Practically every mile of the line, at least within the corporate limits of Chicago, involves special difficulties. At Van Buren Street is the terminal station itself, which has undergone various minor alterations, covered fairly well, however, by the records. At Twelfth Street is the long viaduct crossing over not only the Rock Island-New York Central facilities, but also over the Chicago & Western Indiana group of roads, and the Chicago River. The Rock Island owns several spans of the viaduct and paid in a large part for two north-and-south approaches.

At Sixteenth Street and at South Chicago there have been grade separations—the one some fifteen years ago, the other recently—of two of the most complex railroad grade crossings in the United States. At each point tracks pass in every direction, some straight, some curved, some intersecting at grade, some passing under or over. Ten railroads participated in the work at Sixteenth Street, while five were involved at South Chicago. At each, streets are involved, and with the numerous interchange tracks and connections there is a profusion of bridges, walls and approaches, the division of ownership of which can become known to the outsider only by an exhaustive study of the records and the local topographical conditions.

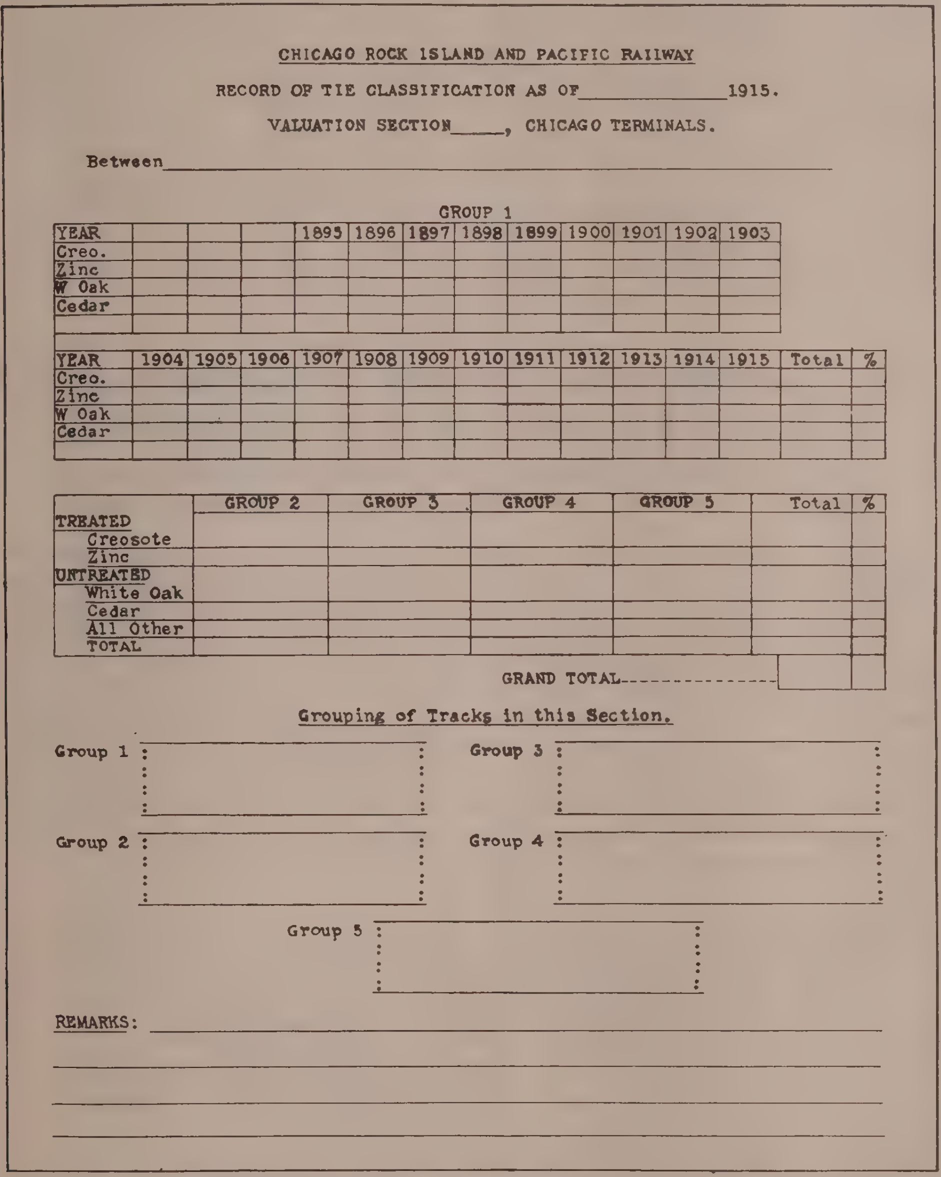
Then at Forty-seventh Street are the locomotive shops, engine house, testing room, etc., of the Rock Island, where with the expansion of the road and the efforts to utilize to the best advantage the limited area available facility has crowded out facility. Here are buildings for which no plans have been found, and masses of buried pipe lines discovered by accident. Probably no inventory could possibly cover all of the physical plant between Forty-seventh and Fifty-first streets.

And at Seventy-ninth Street is a complex piece of recent construction, where the Rock Island passes over the Chicago & West Indiana at an angle of 16 deg. and the Western Indiana in turn passes over Seventy-ninth Street.

Track Elevation in Sections

Throughout the terminal zone, as Chicago rapidly grew, the railroad has also grown, in tracks, freight houses and signal plants. And at the same time expediency or ordinances have forced the elevation of the tracks, one section after another. Each successive section has required semi-permanent transitions and adjustments between the old level and the new at the ends of the sections. At one point there have been three distinct lifts years apart, the first entailing the raising of a grade crossing 5 ft., the second, which was nearly fifty years ago, consisting of a grade raise at the time the entire city was raised off the prairie level so as to provide drainage, and the third to separate the street and railroad grades.

All this has a direct bearing on the original cost, because market and labor conditions and the consequent unit prices may have differed greatly with each construction program. The railroad company can also reasonably contend that it has almost as much bearing on the reproduction cost. In most instances any other method of construction than the piecemeal one employed of first building the railroad on the ground and afterward elevating it would probably have been out of the question, involving a prohibitive amount of hauling of bridge and other heavy material through streets. Consequently the inventory aims to record not only what has been built, but when and how each item was built, so that the original construction conditions may be known preparatory to outlining a reasonable and economical method of reproduction. The prices can then be fixed accordingly.



CHICAGO ROCK ISLAND AND PACIFIC RAILWAY

RECORD OF TIE CLASSIFICATION AS OF______________1915.

VALUATION SECTION_____, CHICAGO TERMINALS.

Between____

GROUP 1

YEAR				1895	1896	1897	1898	1899	1900	1901	1902	1903
Creo.												
Zinc												
W Oak												
Cedar												

YEAR	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	Total	%
Creo.														
Zinc														
W Oak														
Cedar														

	GROUP 2	GROUP 3	GROUP 4	GROUP 5	Total	%
TREATED						
Creosote						
Zinc						
UNTREATED						
White Oak						
Cedar						
All Other						
TOTAL						

GRAND TOTAL--------------

Grouping of Tracks in this Section.

Group 1 :

Group 3 :

Group 2 :

Group 4 :

Group 5 :

REMARKS: ____

THIS FORM ACCOUNTS FOR EVERY TIE—SIMILAR FORMS USED FOR RAIL AND OTHER TRACK PARTS

ORGANIZATION OF VALUATION WORK

The organization of the valuation work is very similar to that used by the government. The whole terminal zone has been divided into two divisions, each in charge of an assistant engineer. The divisions have been subdivided into convenient valuation sections and subsections, those within the track-elevation zone conforming as closely as practicable to the limits of the various elevation programs. The 6.7 miles from the La Salle Terminal to Englewood, for example, are divided into nine subsections.

The inventory of each of the two divisions has been handled by one main roadway party assisted by specialists in various lines—bridges, buildings, signals, machinery and the like. Each party was accompanied by a government representative. Just as where the work is done by government forces, the notes were kept in duplicate on government note forms, with blanks for the signatures of both the carrier's and the railroad's representatives. In cases when other carriers are interested their representatives joined the field party, which for the time being became a joint party with the other carrier or carriers, and copies of all records, notes and the like on the joint utility were supplied to each carrier intended.

The notes are now being worked up and summarized by the railroad's men in office cars maintained by the company, and as sections are completed the originals of the notes and computations are transmitted to the government, the railroad keeping the carbons—or in case of several carriers, blueprint copies.

HIGH STANDARD OF ACCURACY

Because of the larger values involved a much higher standard of accuracy has been maintained than in ordinary country districts. The cross-sections were taken with a wye level and referred to city datum, and all the data and quantities carefully checked and compared. In this way accurate cross-sections of present embankments were possible, but it was still necessary to resort to old profiles and cross-sections to separate the whole grading at various points into that of two or more improvements made at different times.

All available plans of bridges and buildings were compared in the field with the structures they represented. If a few check measurements showed that the structure had been built according to the drawings, no detail survey was made. If there were deviations from the plans, these were carefully measured and if possible indicated on the drawings, otherwise on separate sketches.

The La Salle Street Station is covered by 160 plans. Although in the main the construction agrees with the plans, there have been many minor deviations, particularly in the matter of new partitions and various building changes, and it was no small task to locate these, measure them and correct the drawings. Even this only showed the structure as it is now. As is well known, in a large building of this sort interior changes to meet new requirements are frequent. Careful examination of all available records has been necessary to run these down, and it is probable that no inventory will ever list them all.

More field work has been required for some of the smaller buildings, for which there are no plans, than for larger structures well covered by drawings. Much time has also been spent on interior fixtures. In the present state of the valuation art, with the likelihood that there will be disagreements between railroad and government over features of the final valuations, and that the railroad may be called upon to prove any contentions it may make, the company has deemed it safest to go into minute detail in the construction of buildings and their fittings. Thus for the Forty-seventh Street shops there are 143 pages of building notes. For the racks and other fittings of a two-story storehouse 257 x 60 ft. there are twelve pages of notes, the building itself being covered by ten plans.

FORTY-SEVENTH STREET SHOPS

These Forty-seventh Street shops have been one of the most troublesome parts of the terminal to inventory. Built in the period from 1869 to 1873, when the main tracks were at the low level, they have undergone numerous changes in the effort to keep them adequate for the needs of the rapidly growing traffic. There are two roundhouses, one occupying practically the whole circle. Part of the other was torn down recently. The other facilities include locomotive shops, paint shops, storehouses and a laboratory. Aside from the dismantled locomotives in various stages of repair and reconstruction, suggesting interesting problems for the equipment appraisers, there are machinery of many sorts undergoing changes and replacements even during the period of the inventory; pipe lines and conduits overhead and underground, in use and of known location; walls, tunnels, sewers and the like once useful and so elements of original cost, but discoverable only by study of old plans, or by sheer accident, and undoubtedly similar items not discovered at all.

The field men were not able to apply any formula to the inventorying of this plant. They could only push through by main strength, going over the ground repeatedly, to see that they had not skipped anything, and studying old records and querying old employees for hidden quantities. At best the valuation department believes that a percentage should be allowed for contingencies of inventory, but is not prepared to name the figure.

Photographs are an important part of the notes. Pictures were taken freely of small buildings, signal bridges and other structures; also of types of signs, switchstands and the like, and classifications of masonry—in short, wherever it was thought they would visualize and supplement the field notes or take the place of sketches.

Every Tie and Rail Accounted For

In common with the other railroads, the Rock Island disagrees entirely with the government's interpretation of depreciation (see the Engineering Record of June 17, page 794), and the notes do not include findings of condition per cent. Nevertheless it is the aim in the valuation of the Rock Island Terminal to present the best information for whatever interpretation is accepted. In the matter of buildings the railroad can do little but present records to show when they and their various additions were built. What is held to be a more precise method than the Division of Valuation is using elsewhere, however, is being applied to the elements of track. Each tie and rail is, in fact, accounted for.

The tie-classification form used is here reproduced. The tracks are first grouped according to speed and usage, the grouping being indicated in the blank space below the center of the page. Group 1 covers the main tracks. Group 2 covers switching leads, ladders in yards and other tracks carrying heavy but not high-speed traffic. Passing sidings and the body tracks in yards make up group 3, freighthouse, team and important industry tracks form group 4, while group 5 is confined to the tracks least used. The railroad proposes to file with the Division of Valuation plans showing the grouping. The company is fortunate in that the ties bear dating nails showing when each was laid. In group 1 the ties are classified both as to kind and as to age. In the remaining groups the ages are ignored but the kinds are treated. With this form filled out the company believes that the government can do much better than make a blanket estimate of the condition per cent of all the ties.

A form of the same general type is used for rail, the tracks being grouped in the same way. Under group 1 age, weight, kind and linear feet are given; under the others only weight, kind and linear feet. A third form accounts for tieplates, and also has spaces for short summaries of the ballast and the drainage.

The arrangement between government and railroad covers only the inventory of the physical property of the railroad. As the railroad is taking no part in any findings as to condition per cent except to present the facts of age and kind as aforementioned, so it is not proposing unit prices nor offering data bearing upon intangibles or "other elements of value." The company's valuation department is, however, working along both of these lines, with a view to getting its evidence ready for use at the proper time. Working in conjunction with a committee of all the railroads entering Chicago, all the cost data available on all of these roads in what they designate the Chicago terminal district are being assembled, analyzed and tabulated.

Studies are also being made of the traffic on the various lines, and traffic charts will be filed with the government. These are intended both to give a better understanding of the standards of construction and maintenance required and to aid in determining what values attach to the various lines from the service standpoint, apart from the original and reproduction costs of the "bare bones." Thus far it has been necessary to subordinate these investigations to the demands of the inventory, but with the field work disposed of it is hoped that more attention can be given to them.

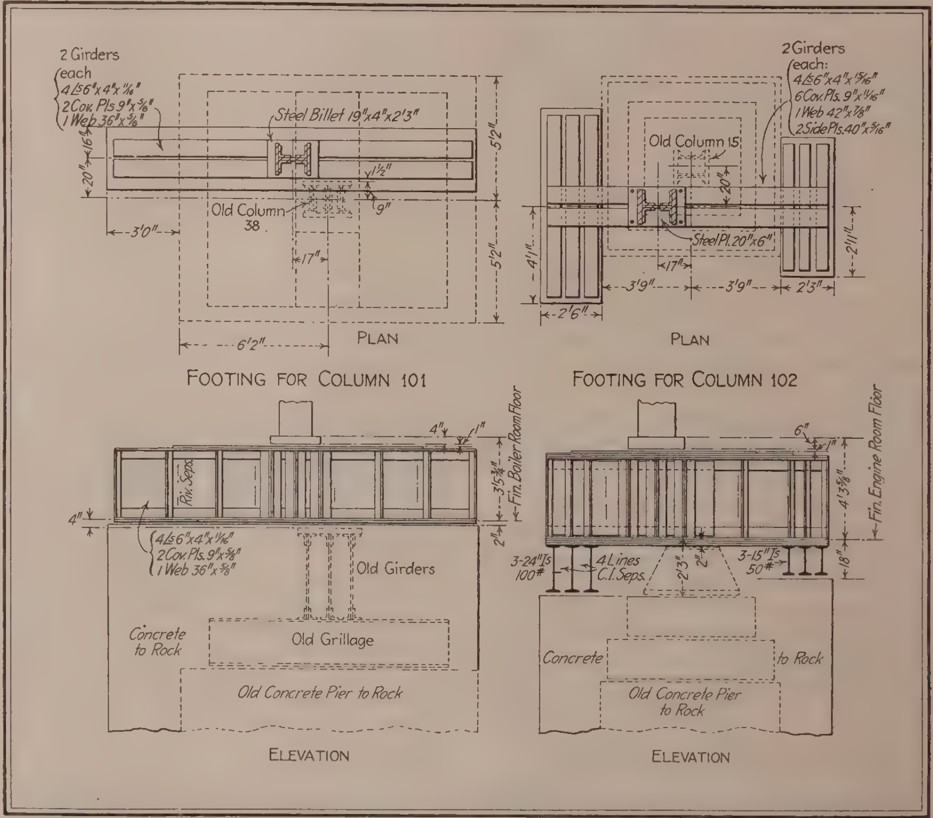
The valuation of the Rock Island terminal zone is being carried out under the general direction of C. A. Morse, chief engineer of the Chicago, Rock Island & Pacific Railway, and chairman of the company's valuation committee, and under the immedate direction of R. H. Ford, engineer of track elevation—R. C. Sattley, valuation engineer, confining his attention to the remainder of the Rock Island system, the inventory of which is nearing completion by the government forces. F. F. Tate is in charge of one of the two main subdivisions of the terminal zone—the work of the other having been finished and the force disbanded—and William Sharpe, cost accountant, with a force of accountants, is working on the records. The field work was started July 18, 1915. A year later it was practically completed, but considerable work still remains in the way of computations and the assembling of the data.

New Columns and Trusses to Support Added Stories in Engineering Societies Building

Special Foundations Adjacent to Old Columns Are Carried Down to Solid Rock—Cantilever and Connecting Trusses with Hangers to Be Used

When the American Society of Civil Engineers voted to join with the United Engineering Societies last June, and the board of direction decided to accept the plan providing for an addition of three stories to the present building on Thirty-ninth Street, in New York City, plans for the structural framework were approved by the city building department before the new height-restriction law was passed on July 25, limiting the height in this district to twice the width of the street. Fortunately, the building code passed since the original design of the existing structure built in 1907 (see the Engineering Record of Feb. 5, page 170) allows higher unit stresses in the present columns in the exterior walls on the west and rear, so that they can carry the added loading without reinforcement.

Four new interior columns have been designed to pass through the building from



TWO TYPES OF FOOTINGS FOR NEW COLUMNS DESIGNED FOR OLD FOUNDATIONS

Columns 101 and 104 and columns 102 and 103 have similar foundations.

new foundations in the basement to the roof, to support long-span trusses just below the present roof. Above these trusses, two of which cantilever over the new columns, will rise the required additional columns, and below them, supported by angle hangers, will be a new stack-room floor, above the present library. The four long new columns are located at the corners of the main auditorium just outside of existing columns, this location being practically fixed by the presence of open-duct or freight-elevator spaces. Furthermore, only slight interference with interior partitions here results, pilasters being used in some floors. The new foundations, adjacent to existing concrete piers and steel grillages, had to be carried to sound rock and required a special design, illustrated herewith.

NEW FOUNDATION DETAILS

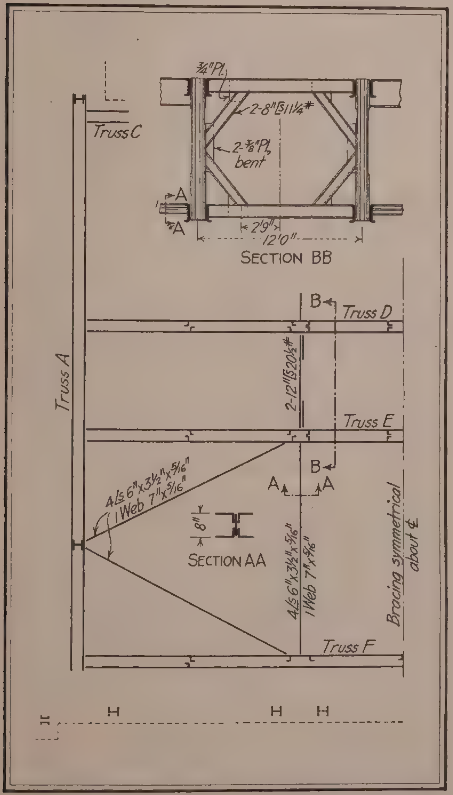
The foundations for the four new columns, carried down about 50 ft. below sidewalk level to sound rock in each case, are of two different types. Columns 101 and 104 will be supported by foundations of the same type, as shown, in which two steel-plate girders above the old steel grillage girders are carried by new concrete placed on one side of the existing concrete pier. Columns 102 and 103 will be supported by a type in which the two plate girders are carried on steel grillages at each end, placed on new concrete next to the old pier on each side.

The foundation work has been carried out with some difficulty because of the restricted working spaces in the basement of the building and interferences with existing columns and walls. Timber sheeting was used for the excavation and the concrete poured against this sheeting as an exterior form. The concrete was mixed by hand on the floor of the boiler room.

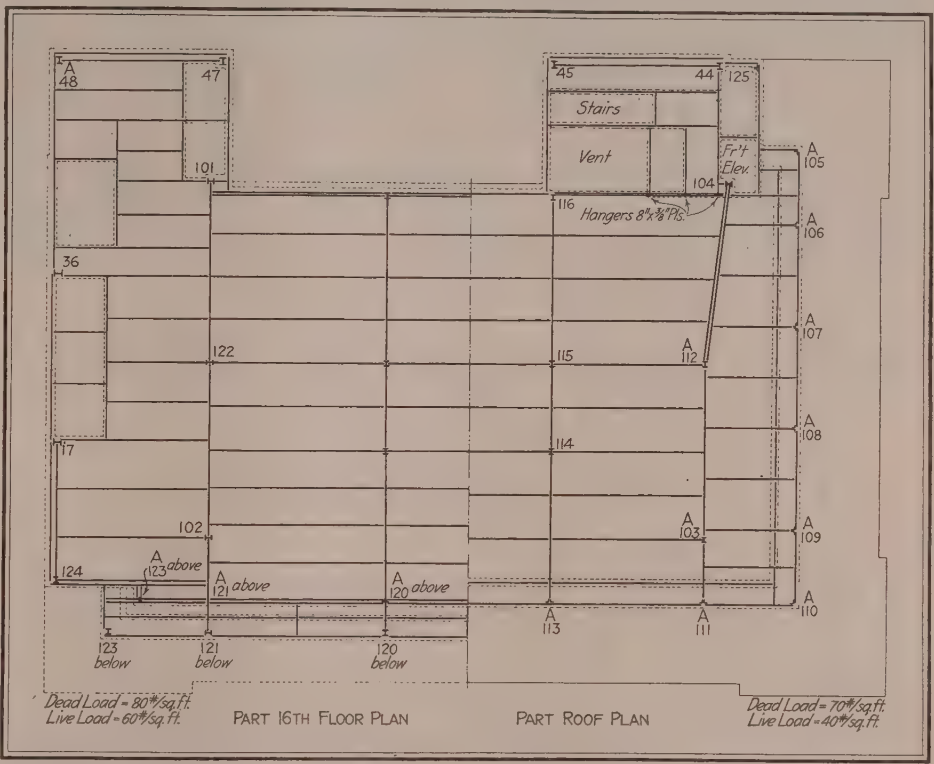
The problem of furnishing support for the additional loading of the new floors quickly reduced itself to a single practicable solution. Owing to the impossibility of gaining access to the present front columns, and the fact that many interior columns do not run straight through the building but are offset at trusses or beam framing which could not be reinforced, the addition of reinforcing metal to existing columns was impracticable. The presence of ventilating ducts and elevator spaces near four interior columns suggested the satisfactory plan of using this waste space for new columns which would support trusses carrying practically all of the increased load by cantilevering over to the front of the building.

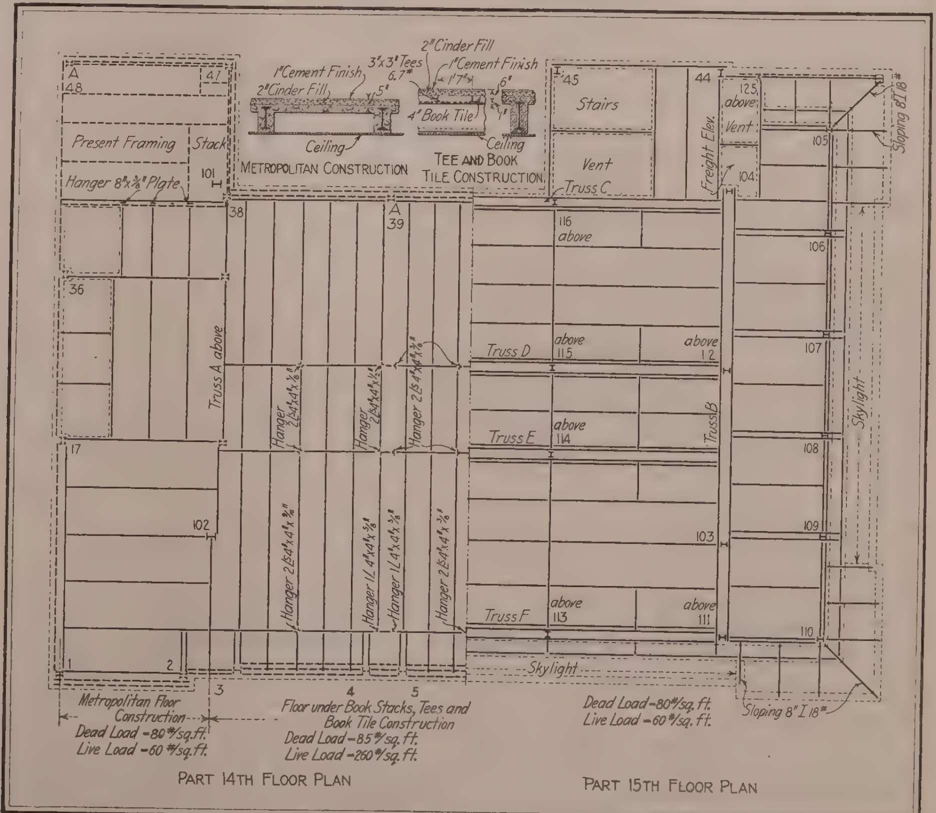
The new columns are of the usual built-up I-section, and carry varying loads, with a maximum of 1,537,000 lb. on column 103. They are about 240 ft. long from foundation to top of trusses near the present roof line and are connected to the existing columns or to floor framing at the various floors by angles or diaphragm connections, as illustrated in typical details in the drawing herewith. The old columns in the rear and west-side outer walls will be spliced to new columns carried to the height of the new roof.

The other columns, as illustrated in the framing plans shown, are located above the



HALF PLAN OF BRACING IN PLANE OF LOWER CHORDS OF TRUSSES



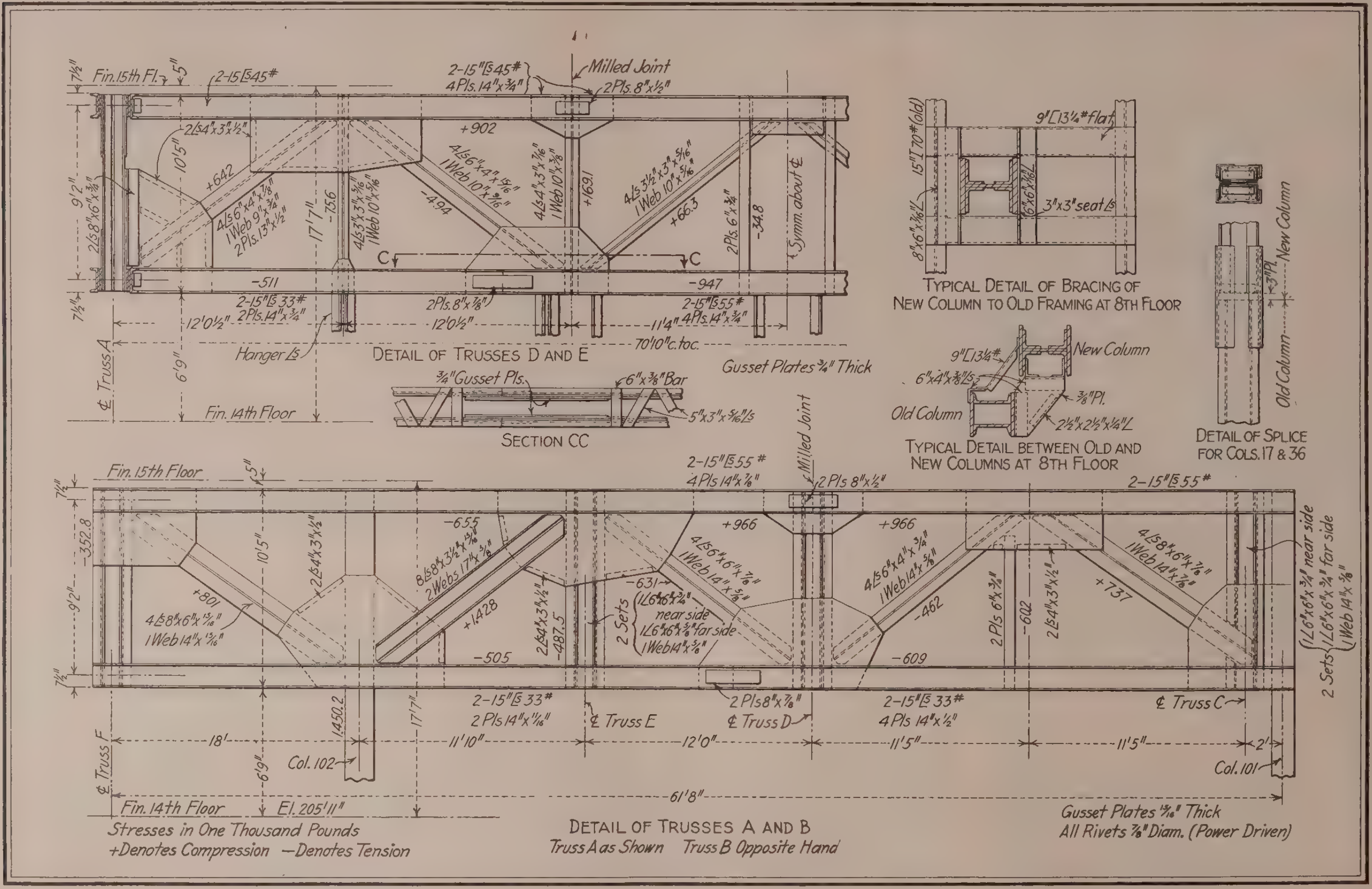


LOCATION OF COLUMNS AND TRUSSES FOR ADDITION TO THE ENGINEERING SOCIETIES BUILDING new trusses, with exterior offsets on the front and east side to produce a pleasing dome-like outline to the added portion of the building. The appearance of the building from Thirty-ninth Street and Fifth Avenue is, by means of a model, being given particularly careful study to avoid the destruction of the architectural harmony of the present structure.

TRUSSES AND DETAILS

The greater part of the added loading is carried by the cantilever trusses *A* and *B*, perpendicular to Thirty-ninth Street, framing directly into the new columns as shown on the detail drawing. Four trusses frame into these end trusses, as indicated by the floor plans, and support the fourteenth or stack-room floor by hangers as noted and the upper floors and roof by columns located as shown on the plan views. This layout was fixed by the location of the supporting columns and the relative position required for the new columns above the present roof line, as well as by the advantageous position of new stack space required to house the Civil Engineers' library.

The live loads, specified on the drawings, were fixed by the building code, except that for the stack-room floor. This value of 260 lb. per square foot was found by assuming books and stacks to weigh 45 lb. per cubic foot, less about 20 per cent for empty space, and including live load on the floor area between stacks at 60 lb. per square foot, then averaging the total. Wind pressure and lateral forces are transferred to the columns by horizontal struts and diagonals in the plane of the lower chords of the trusses, as illustrated.



DETAILS OF CANTILEVER AND CONNECTING TRUSSES SUPPORTING NEW FLOORS BY HANGERS AND COLUMNS

The original design and layout of the Engineering Societies Building was described in articles in the Engineering Record of Dec. 16, 1905, page 686; Feb. 16, 1907, page 186; April 6, 1907, page 449, and April 20, 1907, page 480. The addition is being designed by Henry G. Morse, architect, who was associate architect for the original building, and Purdy & Henderson, of New York, consulting engineers. The total cost up to $250,000 will be borne by the American Society of Civil Engineers, and any excess over this amount will be paid by the United Engineering Societies. The work is divided into two contracts. The first, for the four new columns and foundations, has been let to the Wells Construction Company, and the work is being pushed with the idea of completing this part of the construction, which interferes with the occupancy of the building, before the middle of October. The steel columns are designed of stock material and fabricated by the Bethlehem Steel Company. The second contract, for the remainder of the work, has not been advertised, and will await the final decisions as to floor plans and exterior finish, which are not yet settled. The building committee in charge consists of one member from each of the constituent societies—H. H. Barnes, Jr., H. G. Stott, Charles Warren Hunt and Charles F. Rand.

New List of Geographic Points in Michigan and Indiana

Descriptions, latitudes and longitudes of 865 points in Indiana and Michigan, constituting the horizontal control upon which the topographic maps of the U. S. Geological Survey are built, are given in the recently issued Bulletin 644. Engineers having use for this information may secure a copy by applying to the Department of the Interior.

Creosoting Effective for Fence Posts

Government Tests Indicate That Good Open-Tank Treatment Will Produce Satisfactory Results

GOVERNMENT experiments indicate that creosoting is effective in protecting fence posts against decay, and that an open-tank method of treatment is the most satisfactory. The service tests have been conducted by the U. S. Forest Service in co-operation with various state agricultural experiment stations on posts installed between 1906 and 1909, and are discussed by Harlow Bradley, assistant engineer in forest products, U. S. Forest Products Laboratory, in Bulletin 187 of the American Railway Engineering Associaton. These notes are taken from his paper.

The posts were given a variety of treatments in an effort to develop the most satisfactory apparatus and method for use on the farm, this being the primary object of the experiment. The open-tank method of treatment, which has proved to be the most practical for this purpose, is carried on about as follows:

The butt of the post is soaked for a time in the hot preservative (200 to 220 deg. Fahr.). In this way the air and moisture in the wood are expanded and partly forced out, very little oil being absorbed during this operation. The post is then allowed to cool in the same oil for several hours. As the interior of the wood cools, the air contracts and the preservative is drawn in. This is known as a single-tank treatment. The top of the post remains untreated. At the end of the hot bath the post may be removed and either the butt or the entire post submerged in a second tank containing cold or cooling oil. This is the double-tank treatment, and where the post is totally submerged, the top receives a like treatment owing to the soaking action of the wood.

Either the single or the double-tank method of treatment was applied to most of the posts, although the brush treatment, soaking treatment (in cold oil) and charring were also tried. The brush treatment consists in painting the posts with two or three coats of hot creosote, generally using a wide brush for the purpose. In the soaking or dipping treatment the posts were merely submerged in cold or warm oil for a few minutes. The soaking treatment should not be confused with the open-tank treatment, which depends on the partial vacuum created within the wood by the contraction of the air.

The experiment was carried out in cooperation with the following agricultural experiment stations: South Carolina Agricultural Experiment Station, Clemson College; Alabama Polytechnic Institute, Auburn; North Louisiana Agricultural Experiment Station, Calhoun; University of Minnesota, Zumbra Heights; Iowa State College, Ames; Maryland Agricultural College, College Park.

CONCLUSIONS

The data show that nondurable species, especially in the South, should have at least a light top treatment in addition to the heavier butt treatment. Brush treatments, soaking in cold oil, and double-tank treatments where asphaltum was used as the heating medium in the hot bath were not very effective in preventing decay in nondurable species. Charring was apparently of no value. Care must be taken to have the butt treatment extend well above the ground line to allow for possible changes that may occur in the ground level, and for possible carelessness in setting.

Butternut and willow decayed so readily in the tops that a heavy treatment of the entire post seems advisable. An especially good treatment appears necessary in basswood if satisfactory service is to be obtained.

Conditions seem to be more favorable for decay when posts are set around barnyards than when set in fields or woodlots.

The results clearly indicate that a good open-tank treatment of fence posts with creosote will give satisfactory results in preventing decay in most of the nondurable species.

Posts treated with water-gas-tar creosote and water-gas tar have stood up very well thus far. Those treated with the creosote are in somewhat better condition than those treated with the tar.

MIXER LAYOUT AND CONSTRUCTION TRESTLE—NORTH END OF BRIDGE

Central Bridge at Lawrence Is Built from Four Separate Mixing Plants

Construction Trestle Used Over Shallow Merrimac River—Three Caissons for One Bascule Pier Sunk Under Compressed Air

By E. K. CORTRIGHT
Resident Engineer at Lawrence for B. H. Davis, Consulting Engineer, New York City

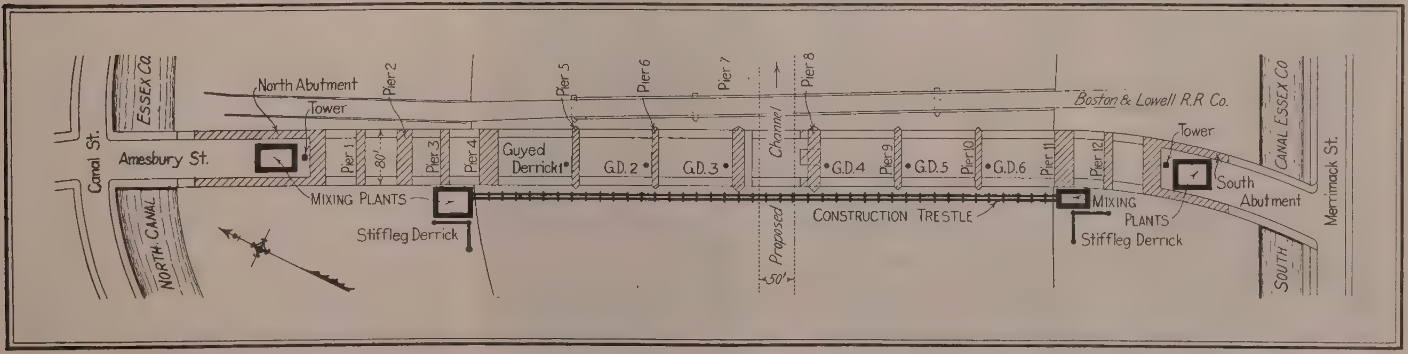
IN MAKING the plant layout for the construction of the Central Bridge at Lawrence, Mass., only a small amount of floating equipment could be used because there is normally only 3 ft. of stream flow in the Merrimac River at this point. This condition, together with the very limited space available at either end of the structure, resulted in an unusual concrete plant layout with four separate 1-yd. mixers used in combination with a construction trestle.

Two heavy bascule piers, one of which rests as a spread foundation upon compact gravel, the other on three separate caissons carried to bedrock by compressed air, provide for the possibility of future navigation. In concreting the river piers above the top of the foundations no horizontal joints were permitted, the only joints being in vertical planes parallel to the center line of the bridge.

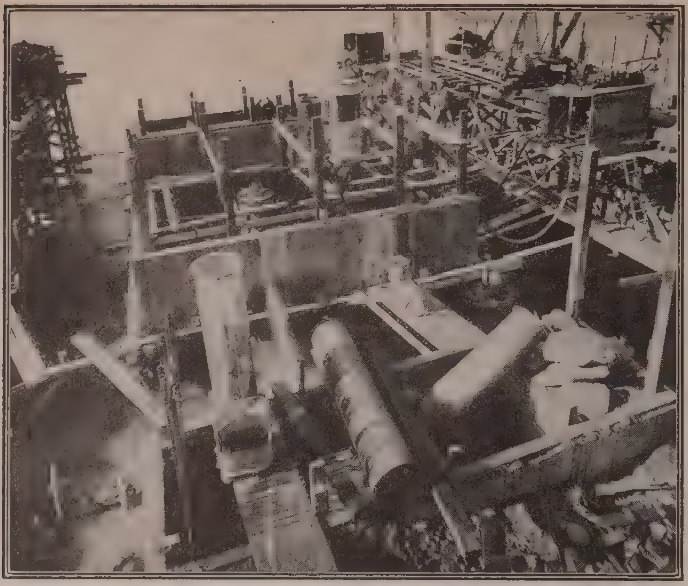
PLANT LAYOUT

The Lawrence Central Bridge is a reinforced concrete structure, 1750 ft. long by 80 ft. in width, spanning the Merrimac River at the foot of Amesbury Street, Lawrence. The design involves 200 ft. of retaining wall of the counterfort type, with earth-fills at either end of the bridge. There are six 107-ft. three-centered reinforced-concrete arch spans of the open-spandrel type, one temporary 90-ft. concrete arch span and six 44-ft. segmental arch rib spans. After investigation the contractors decided not to use a cableway for the following reasons: The limited space available for towers, anchorages, etc.; the width and length of the structure, the necessity of moving heavy steel centers, and finally the difficulties of attempting to place concrete, erect forms, and distribute materials of construction simultaneously.

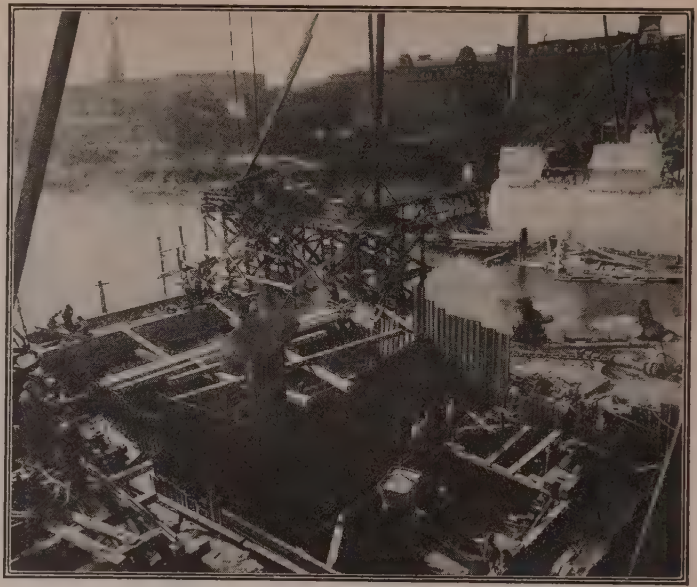
The method adopted was to erect a derrick on pile bents adjacent to each pier at the elevation of the springing line. At the bascule piers an additional car derrick was placed in order to be able to drive sheeting and carry on excavation at the same time. Along the up-stream side of the work a temporary trestle was constructed which served as a supply line for



FOUR MIXING PLANTS SERVED THE FULL 1750-FOOT LENGTH OF CENTRAL BRIDGE AT LAWRENCE, MASS.



COMPRESSED AIR CAISSON FOR SOUTH BASCULE PIER



CONCRETING THE FOUNDATION OF THE NORTH BASCULE PIER

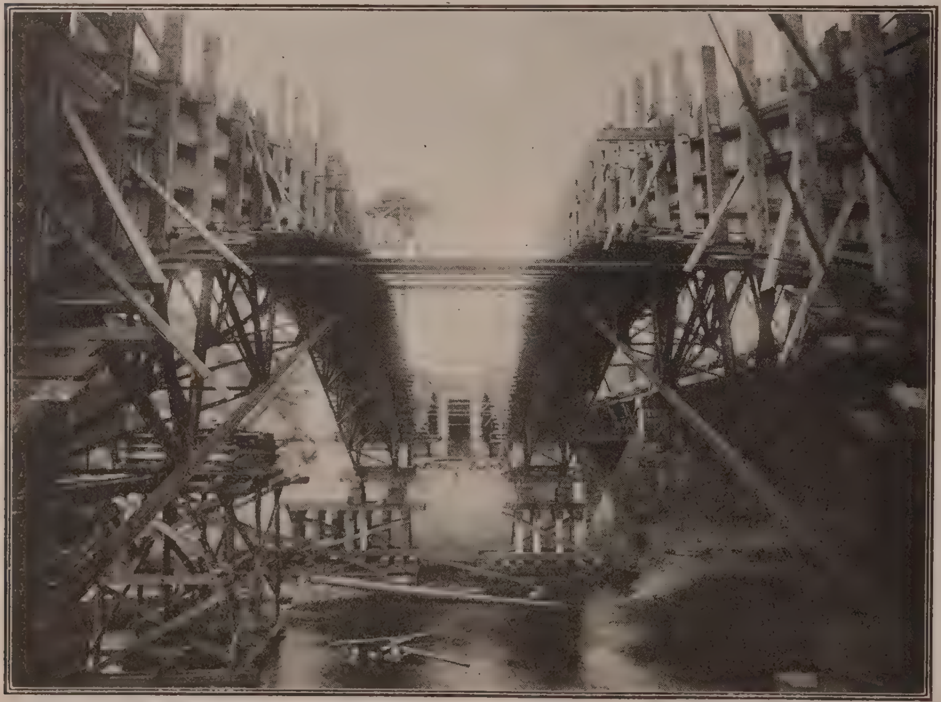
all the river work. For concreting, the work was divided into four sections, as follows: Retaining walls and arch ribs of the north approach, river work north of the temporary span, river work south of temporary span, and south approach retaining walls and arch ribs. Each section was supplied with a 1-yd. Smith mixer. For the approach work two Insley towers, approximately 100 ft. in height, were used to chute all concrete within a 1:3 pitch from the tower, while for the river work the mixers discharged directly into buckets mounted upon cars on the temporary trestle.

DOWNSTREAM HALF BUILT FIRST

The piers to the springing-line elevation were completed for the full width of the bridge. In building the superstructure the down-stream half of the work was first finished; upon its completion all derricks at the river piers were taken down and the up-stream or remaining half of the work built with traveling stiff-leg car derricks erected at either end upon the completed roadway.

A double row of test borings of the site showed the rock surface to lie at least 35 ft. below normal water. This condition, together with the hard and compact nature of the river bed, justified the design of a spread foundation at elevation —7.0 for the river piers, a depth of about 14 ft. below normal water. In the construction of these piers 4-in. hard-pine sheet piling, 24 ft. long, grooved and splined, was set up in two sets of 6 x 8 in. walings, which in turn were bolted to guide piles on the outside of the cofferdam.

Each cofferdam, 22 x 95 ft. in plan, was sheeted, driven, unwatered, excavated and concreted as a unit. A 1500-lb. drop hammer swung in leads from the derrick booms did all the driving through about 12 ft. of gravel, and no difficulty was experienced later in pulling this sheeting. In most cases there was but little trouble encountered from leakage due to the care taken in setting, driving and bracing the wood sheeting. All of the excavation in these piers was done with an orange-peel bucket. Upon reaching the required depth a 2-ft. layer of concrete was deposited to seal the bottom, after which forms were built and the concrete brought to the top of foundation, any leakage of water being drained along the sides of the cofferdam. Above the top of the foundation these piers are monolithic, having no horizontal joints and only two vertical joints parallel to the axis of the bridge, spaced so as to divide the entire pier into three equal parts, each section holding about 300 cu. yd. of concrete, which was placed in a continuous run of sixteen hours.



STEEL ARCH CENTERS ON TIMBER BLOCKING SUPPORT THE ARCH RING FORMS

BASCULE PIERS

In the original design no provision was made for navigation, but legislation subsequent to the signing of the contract necessitated the erection of two large abutment piers to provide for the future installation of a bascule span in the middle of the channel when the Merrimac River is made navigable. A recent act of legislation has permitted the erection of a 90-ft. temporary unreinforced-concrete span, to be replaced with a double-leaf bascule drawspan upon the demand of the federal authorities when the river is opened for navigation.

Below the springing line these piers are designed to act as abutments for the adjacent 107-ft. spans, while above the springing line there are provided a series of dry joints which will permit the building of either a steel bascule span or a temporary concrete arch span to be removed at such a time as the river may be made navigable.

SPREAD FOUNDATION FOR NORTH PIER

In laying out the north bascule pier, it was the intention to use three separate caissons, 15 x 38 ft. in plan, of steel sheet piling driven to rock. On account of an irregularity of the rock profile not disclosed by the borings, it became necessary to alter the original design and build this pier upon a spread foundation for its full length, on compact gravel about 36 ft. below normal water. The material encountered about 18 ft. below the river bed proved to be a gumbo clay of such extreme tenacity that an orange-peel bucket would make little or no impression upon it, and which could be removed by hand only with great difficulty.

The great depth of the underlying rock and this peculiar clay formation made open-caisson work very slow and expensive, and caused the introduction of compressed-air work in the south bascule pier. Three caissons, 15 x 38 ft. in plan, were sunk to bedrock 40 to 60 ft. below normal water. This air work was done as a subcontract in 83 days and involved 3000 cu. yd. of excavation and 2300 cu. yd. of concrete. Much of the troublesome clay formation was jetted and blowpiped from the caissons.

ARCH SPANS

The 44-ft. segmental approach arches consist of seven ribs 30 and 36 in. wide, about 12 ft. on centers, and provide a direct bearing for the floor slab. These spans occur in pairs and are reinforced for continuity over the intermediate piers, although in the design no allowance was made for possible balanced cantilever action. Investigation proved the economy of wood centering over steel for these small spans. All framing for the sides and floor was made in panels and used six times.

For building the main 107-ft. spans three-hinged steel arch centers were used for the two outside ribs, 9 ft. in width, and one middle rib 16 ft. wide. Pile bents with a permissible load of 10 tons per pile were driven about 10 ft. into the river bottom to support the centers. As only the abutment piers were capable of sustaining the unbalanced thrust of the dead load, centers for one-half of the transverse width of the bridge for three spans were provided. All centering was kept in place for twenty-eight days after the final keys were poured, and was then lowered by means of hydraulic jacks and moved transversely on rollers to complete the remaining half. The steel centers were given a camber of 3 in., which in most cases proved sufficient, although not excessive, there being about 1-in. settlement in the piles and blocking, about 1-in. deflection of the steel work and 1-in. deflection of the concrete arch ring under its full load.

These arch rings were poured as a series of alternate blocks and keys in order to facilitate the work and to prevent the occurrence of cracks due to settlement of centering and shrinkage of concrete. Each ring was divided into five large blocks separated by small key blocks, which were poured after the main blocks had been allowed to set and shrink for one week. The outside faces of the outer arch ribs were divided by scorings into voussoir blocks and have a water-dike molding along the extrados projecting above and 3 in. beyond the face of the arch.

FLOOR SYSTEM

The roadway is 56 ft. wide between curbs, with provision for two electric-railway tracks, and the sidewalks are each 11 ft. wide exclusive of concrete balustrades and the lamp-posts, which were also constructed of reinforced concrete and made high enough to support the cross-wires for the electric railway. In order to provide for ballast under the electric railway tracks without unnecessary dead load, the floor slab was lowered 9 in. for a width of 23 ft. throughout the length of the bridge.

The clear span of 20 ft. between arch rings and the fact that no steel centers were provided for the floor system raised a question as to the best method for framing the floorbeams. Investigation showed that to carry the total weight of 25 tons of wet concrete in the beam and adjacent slab, the side forms of the floorbeams would have to be 4 in. thick and trussed with two ¾-in. round rods with a 1¾-in. pin connection at either end. This method was followed and eliminated the necessity of shoring and proved ample to carry the weight without appreciable deflection.

The approximate quantities of the more important items involved in the work are: 36,000 cu. yd. of concrete, 625 tons of steel reinforcing, 10,000 cu. yd. of river excavation and 5000 cu. yd. of dry excavation.

The Central Bridge now nearing completion is being built for the city of Lawrence under the direction of the Lawrence Bridge Commission, of which John J. Donovan of Lawrence is chairman. B. H. Davis, consulting engineer, New York City, is the engineer, and the contractors are Ryan & Keon of Boston. The Merrill-Ruckgaber Company of New York was the subcontractor for the pneumatic work and the Boston Bridge Company supplied the steel centers. Fred L. Mulcahy is the inspector.

Literature

For the Civil Engineer and Contractor

New Publications

THE HEAT TREATMENT OF TOOL STEEL. By Harry Brearley. Second edition. Cloth, 6 x 9 in.; 222 pages; illustrated. New York and London, Longmans, Green & Company. $3.50 net.

An illustrated description of the physical changes and properties induced in tool steel by heating and cooling operations.

PROCEEDINGS OF THE TWENTY-EIGHTH ANNUAL MEETING OF THE IOWA ENGINEERING SOCIETY. Paper, 6 x 9 in.; 164 pages; illustrated. Iowa City, Iowa, published by the Society. 50 cents.

REPORT ON PIPE-LINE TRANSPORTATION OF PETROLEUM BY U. S. FEDERAL TRADE COMMISSION. Paper, 6 x 9 in.; 467 pages; illustrated. Washington, Government Printing Office.

THE STABILITY OF ARCHES. By Ernest H. Sprague, assistant at University College, London; lecturer at the Westminster Technical Institute. Cloth, 5 x 7 in.; 138 pages; illustrated. London, Scott, Greenwood & Son; New York, D. Van Nostrand Company. $1.25 net.

INDUSTRIAL CONDITIONS IN SPRINGFIELD, ILL. By Louise C. Odencrantz and Zenas L. Potter. Paper, 6 x 9 in.; 173 pages; illustrated. New York, Russell Sage Foundation, Department of Surveys and Exhibits. 25 cents.

STRESSES IN STRUCTURES. By A. H. Heller, late professor of structural engineering, Ohio State University. Revised by Clyde T. Morris, professor of structural engineering, Ohio State University. Third edition. Cloth, 6 x 9 in.; 374 pages; illustrated. New York, John Wiley & Sons. Inc.; London, Chapman & Hall, Ltd. $2.75 net.

CONCRETE LININGS FOR IRRIGATION CANALS. Paper, 6 x 9 in.; 15 pages; illustrated. Chicago, Portland Cement Association.

Booklet for free distribution, illustrates several examples of the application of concrete to prevent losses from seepage in canals.

THE LAND-TITLE REGISTRATION ACT OF THE STATE OF NEW YORK. Indexed, with introduction by Dorr Viele and Joseph C. Baecher of the New York Bar, official examiners of title. Second edition. Paper, 6 x 9 in.; 87 pages. Albany, Matthew Bender & Company, Inc. 50 cents.

BRICK ROADS. By V. M. Pierce, chief of construction, and Charles H. Moorefield, senior highway engineer, U. S. Office of Public Roads. Bulletin 373. Paper, 6 x 9 in.; 40 pages; illustrated. Washington, Government Printing Office.

A revision of Bulletin 246, entitled "Vitrified Brick Pavements for Country Roads."

ELEMENTS OF CHART MAKING. By E. Lester Jones, superintendent, U. S. Coast and Geodetic Survey. Special Bulletin 38. Stiff paper; 6 x 9 in.; 15 pages; illustrated. Washington, Government Printing Office.

Technical and practical details involved in the preparation of a chart for the use of navigators are outlined in a nontechnical manner. Includes field work and office details.

PRACTICAL SAFETY METHODS AND DEVICES—MANUFACTURING AND ENGINEERING. By George Alvin Cowee, E.M., S.B., manager, Bureau of Safety, Utica Mutual Compensation Insurance Corporation. Cloth, 6 x 9 in.; 434 pages; illustrated. New York, D. Van Nostrand Company. $3 net.

CONCRETE SWIMMING AND WADING POOLS AND HOW TO BUILD THEM. Paper, 6 x 9 in.; 18 pages; illustrated. Chicago, Portland Cement Association.

Booklet for free distribution; gives many examples and typical plans of reinforced-concrete swimming and wading pools.

CALCULO DE ESTRUCTUROS. By Juan Manuel de Zafra, professor in Las Escuela Especial del Cuerpo. Two volumes. Cloth, 7 x 9½ in.; 608 and 786 pages; illustrated. Madrid, Tejada y Martin. 50 pesetas ($9.65) per volume.

Among the original features of this complete work on the analysis of structures may be mentioned the solution of the problems of multiple arcades, triangular reticulated structures and trapezoidal structures. Many of the problems require the solution of simultaneous equations, and the appendix of the second volume describes a mechanical equation solver which is actually under construction.

Books Reviewed

Bridge Engineering

Author, J. A. L. Waddell, C.E., B.A.Sc., Ma.E., D.Sc., D.E., LL.D., consulting engineer. Two volumes. Cloth, 6 x 9 in.; illustrated; Vol. 1, 1064 pages; Vol. 2, 2177 pages. New York, John Wiley & Sons, Inc. $10 per set.

REVIEWED BY F. H. CONSTANT

Professor of Civil Engineering, Princeton University, Princeton

The mere announcement that a treatise on bridge engineering of nearly 2200 pages has appeared from the hand of Dr. Waddell is sufficient introduction. Manifestly an extended review is impossible, for the work includes some eighty chapters, many of which are themselves in the nature of individual professional papers upon which the reviewer could linger at length. Nor can he take refuge in its sheer size, giving merely a list of chapter headings. Those familiar with the author's little work, "De Pontibus," which first appeared some eighteen years ago, will recognize the same interesting, piquant, almost conversational style.

Engineering books are, as a rule, singularly devoid of any charm of style, being either devoted to the mathematical development of theory for text-book use or dryly descriptive. The present work is neither. It is the interesting, personal, almost autobiographical, narrative of a notable professional career. It holds the reader, not solely because of the value of the subject matter, but because it is a very readable book, full of personal, often humorous, incidents and touches. Like his notable paper, "Some Disputed Points in Railway Bridge Designing," which was published in 1892 in the *Transactions* of the American Society of Civil Engineers, and which awakened widespread discussion at that time, it contains many a challenge or conclusion which the reader would like to discuss at length.

The aim of the book is stated in the preface as follows: "In writing this book it has been the author's aim to give to his readers, concerning every branch of bridge work, all the information he has been able to accumulate during a practice of forty years. Nothing of any value has been omitted, except such matter as can readily be obtained from other books, because he has never been a believer in the pseudo-economic idea that what has cost much labor and money to discover and record should be utilized only for one's personal gain. On that account there appear for the first time in print all the diagrams of weights of metal, quantities of masonry, costs of constructions, economic functions, etc., that this book contains."

These records, diagrams, digests, systematic analyses, etc., are presented in the form of several hundred tables and cross-section diagrams of curves. In giving this information to the public Dr. Waddell certainly merits the thanks of all engineers.

Contents of Volumes

In spite of their number no adequate idea of the scope of the work can be formed without a list of the chapter headings; space will not permit of any review of the chapter contents.

Volume 1—Evolution of bridge engineering; the bridge specialist; ordinary materials of bridge construction; alloy steels in bridge work; dead loads; live loads; impact loads; centrifugal force and other effects of track curvature; wind, vibration and traction loads; methods of stress computation; secondary, temperature and indeterminate stresses; deflections; combination of stresses; working stresses; first principles of designing; detailing; shop work; classes of traffic; floor system; laterals and swaybracing; plate-girder and I-beam bridges; simple truss bridges; trestles; viaducts and bridge approaches; elevated railroads; cantilever bridges; arch bridges; suspension bridges; movable bridges; swingbridges; bascule bridges; vertical-lift bridges; riveted versus pin-connected trusses; dimensioning for camber; protection of metal work, wooden bridges and trestles; drawbridge protection; reinforced-concrete bridges; foundations; cofferdams; open-dredging process; pneumatic-caisson process; piles and pile-driving; piers; pedestals; abutments; retaining walls and culverts, and shore protection.

Volume 2—Expedients in design and construction; data required for designing; location and surveys; borings; waterways; governmental requirements; hydrographic surveys; esthetics in design; true economy in design; determination of layouts; weights of steel superstructures; quantities for piers, pedestals, etc.; estimates; office practice; inspection; triangulation; engineering of construction; erection and falsework; maintenance of traffic; bridge examination; reconstruction; maintenance and repair of existing bridges; status of highway-bridge building; bridge failures and their lessons; specifications in general, contracts; reports; administration; arbitration; promotion of projects; fees; business features; responsibility of the bridge engineer; ethics; general specifications for superstructure; glossary of terms and index.

Glossary of Terms

The glossary of terms covers 223 pages, the index 60 pages. It will be noted that the first volume is the more technical; the second, the more general of the two. While the work is not primarily concerned with the development of formulas, it contains many such, especially for use in the design of reinforced-concrete bridges. The reader is constantly referred, by name and often by page, to other books for the development of such formulas or for a more theoretical treatment of the subject. References to technical papers are interspersed freely throughout the text. Cross-referencing to other books or papers and the discussion of text illustrations not reproduced in this book are likely to be inconvenient for the reader who may not have these other works at hand.

In relation to its field of usefulness the author states: "Primarily the book should prove useful to all engineers who are engaged either directly or indirectly in the designing and building of bridges, and especially to the younger ones, for not only are the principles of design explained and exemplified, but also many practical hints are given, which otherwise would come to them only through wide experience. With the various tables and diagrams it is feasible to make quickly a close estimate of cost for nearly every kind of bridge and for structures of any length or size yet attained, no matter what may be the complication of traffic that they have to carry. Again, in respect to spans of unprecedented weight and length, data are given for determining, at least approximately, the weights of metal required by the use of alloy steels of various elastic limits."

In regard to its use in engineering schools he says: "While the work was not prepared as a text book for engineering students, it is well adapted to supplement the standard treatises used in the classroom."

In the conclusion of the preface the author states "that he considers this book to be the greatest and most important work of his entire professional career, which has been an unusually busy one; and most certainly he would be bitterly disappointed if, for many years to come, it should fail to prove of great value to the engineering profession."

Dr. Waddell will not be disappointed. His readers will not fail to appreciate the sacrifice of time and money involved in the making of this great book and its real value to them in their work.

The Construction of Roads and Pavements

Author, T. R. Agg, civil engineer and professor of highway engineering, Iowa State College. Cloth, 6½ x 9½ in.; 432 pages; illustrated. New York, McGraw-Hill Book Company, Inc.; London, Hill Publishing Company, Ltd. $3 net.

Reviewed by Henry G. Shirley
Chief Engineer, State Roads Commission, Baltimore

In this volume of twenty chapters dealing with the construction of roads and pavements the first gives a brief description of the development of highway systems and discusses the progress and growth of this branch of engineering. Chapter 2 covers in a concise and complete form the general rules for making plans and surveys. Chapter 3, on "The Design of Rural Highways," gives many cross-sections of the different roads throughout the country, and is of great value. Chapters 4 to 13 inclusive treat the construction of all types of roads, from the sand-clay road to the stone-block pavement, and give the latest methods used in construction and many examples of pavements, as well as many helpful views. These chapters are well handled, and contain many tables that will be of great value not only to the student but to the engineer in practice as well.

Chapters 14, 15 and 16 consider the treatment of roads with bituminous materials, dust layers and asphaltic surfacings, including the penetration methods, sheet asphalt and asphaltic concrete, as well as bituminous carpets for the maintenance and preservation of macadam and other types of road surface.

Chapter 17, entitled "Selection of Type of Surface for Rural Highways," and Chapter 18, on "Selection of Type of Pavement Surface," are well written and will be of much value to the young engineer in selecting the proper type of road under the many varying conditions. Chapter 19, "The Design of Pavements," is presented in a clear fashion, accompanied by well-selected illustrations. The tests for bituminous road and paving materials are set forth in Chapter 20, which gives the latest and most improved methods of testing such materials.

As a whole, the book is concise and well arranged. It gives data that will be of great assistance to the student, and will make an exceedingly valuable book of reference for the engineer who has the actual charge of designing and constructing roads and pavements. It is a desirable addition to existing highway literature, and no highway engineer's library will be complete without it.

Photographs as Specifications

All Data the Contractor Needs in Bidding on Work Proposed by Portland, Ore., Contained on Prints from Camera Negative

PORTLAND, ORE., has prepared and issues in printed loose-leaf form standard specifications for all material and methods to be used in all structures and work carried on under the city's supervision. These specifications do not, of course, refer to any particular work, but are strictly general in character and are issued unbound to any contractor on application. This plan simplifies the preparation of specifications on new work to such a degree that but little more than detailed drawings is necessary.

The labor of getting out specifications is still further simplified by photographing both the text and the drawings, so that the space covered and the cost of producing one or two dozen copies are a minimum. This is made feasible by typing the specifications, single space, on a sheet about twice letter-head size, and then making an 8 x 10-in. negative of the large sheet. The drawings are likewise photographed on 8 x 10-in. plates; and even though certain minor details and figures are lost in process of reduction, it is believed that for estimating all the data really needed will be legible. For construction purposes, of course, blueprints of the original drawings are used.

Under this system the amount of text accompanying the drawings, even on extensive work, is notably slight, and this is because wherever materials or methods are involved which are covered in the list of standard specifications already referred to, the page and paragraph of the references are all that need be given to make the standard list a part of the contract covering the particular work in hand.

Photographs of specifications for small jobs are printed on heavy velox paper, and where more extended reference is anticipated a special cloth paper is used. In either case the collection of photographs of drawings and text is fastened together inside a cloth blueprint cover, on the outside of which the title and general information are printed.

The plan has been used for some time by Philip H. Dater, city engineer of Portland.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Cobble Gutters

SIR: In reviewing the standards of cobble gutters on state improved highways, one will find them not different from any other kind of standards in spirit and effect. Besides being too general and carrying with them the tendency of creating an indifferent mind and stale initiative, they are incomplete. There is no discrimination shown between the various kinds of soils encountered, or the presence of grades, tangents or curves, as to the width of the cobble gutter.

I have observed many a washout of cobble gutters due to lack of proper width of cobble pavement on shoulders, especially on sharp curves and steep grades, of big watersheds. The inertia of the water leading from a gutter on a tangent down a steep grade to a gutter on a sharp curve will invariably cause erosion into the bank on the outside and into the shoulder on the inside of the curve. This process will continue until the cobble gutter is undermined and washed out. On narrow shoulders this erosion may undermine the pavement of the traveled roadway and cause considerable damage.

Evidently the subject of cobble gutters is being looked upon as unimportant, and is generally neglected. M. P.

Eccentric Loading on Columns

SIR: The writer has read with much interest Mr. Fleming's discussion of the stresses arising in columns due to eccentric loads, in the issue of Sept. 2, page 296. He has verified the values of the bending moments and horizontal reactions there given. Our formulas for the strength of columns have been derived from both theory and experiments, but it has been assumed that the loading was concentric; yet it will be found by inspecting Mr. Fleming's article and sketches that the stresses due to eccentric loads are not only large, but vary in intensity from top to bottom of column.

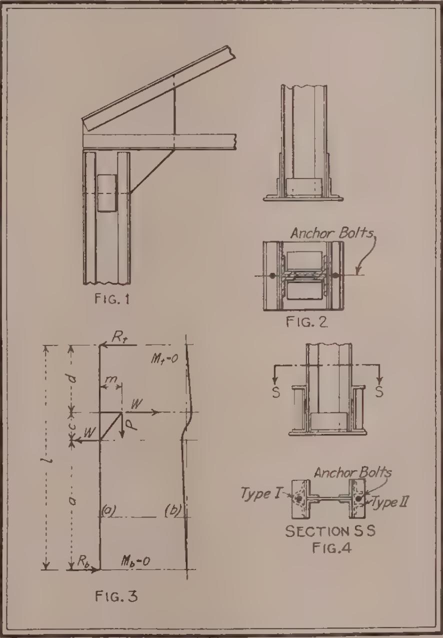
The writer believes that it is possible to make a slender mill-building column continuous at top by using the detail shown in Fig. 1, which also stiffens the building generally. But in an ordinary mill-building column with a base of plate and angles, Fig. 2, it is impossible to get a fixed end, as seems demonstrated by the following:

Fig. 3 shows a column with bracket, similar to Mr. Fleming's Fig. 1, with both ends assumed to be hinged. An investigation has been made to determine the position of the axis, assuming the column to have a constant cross-section. It has also been assumed that the column axes at top and bottom are in the same vertical plane when exposed to the pair of forces supplied by the girder bracket, Fig. 3 (a and b). If the column be considered as a beam supported, not restrained, at the two ends, and subject to a couple acting somewhere between the ends, the equations for the deflection in sections d, c and a can be written, and finally the tangent of the elastic line at the base of the column found to be:

$$\frac{dv}{dx}=\frac{Wc}{2EI}\left[\frac{l}{3}-\frac{c^2}{3l}-\frac{cd}{l}-\frac{d^2}{l}\right]$$

Taking as a practical example a column of four angles 6 x 4 x ½ and one plate 18 x ½, the moment of inertia I about an axis perpendicular to the web plates is 1525. Assume the length of column, as in Mr. Fleming's example, to be 24 ft., and also assume a as 14 ft. and W as 10,000 lb. Then c is 2 ft. and d is 8 ft. Solving for dv/dx there is found 0.0001089 for the tangent of the angle of the elastic line of the base of column. Hence the angle is about one-half of one minute. If the base plate is 27 in. wide we shall have a deflection of its extreme edge below the center of 0.0015 in., a very small amount.

It is not likely that any other condition can prevail than the hinged or slightly held condition, as a concrete pier will compress such a slight amount very readily, the ratio of good concrete and steel moduli being about 1 to 15. In addition to the compressibility of the concrete pier there is the condition of the usual steel-base attachment, Fig. 2, for which it is reasonable to assume that the base plate and side angle will bend somewhat. It seems, therefore, that to assume the lower end fixed is erroneous.



FIGS. 1 TO 4—DETAILS OF COLUMNS

Somewhat better is a column as indicated in Fig. 4, which is more expensive and not used very often. Here the objection of the yielding base is overcome by a strong side attachment with rivets in shear, and lugs for anchor bolts deep enough not to yield under the pull of the anchor bolt. This does not overcome the effect of yielding of the concrete pier, which renders the base probably somewhere between fixed and hinged, as mentioned by Mr. Fleming.

In an office building column, spliced with side plates parallel to one axis, and two small clip angles parallel to the other axis, it is likely that the column is continuous all the way down if the eccentric load is applied in a plane normal to the splice plates. If applied in a plane parallel to the splice plates, there seems likely to be some motion, enough to destroy the continuity.

This subject is interesting not only as a theoretical problem but for practical reasons. As the exact determinations of the stresses would be somewhat expensive in an office, it is a good plan on each separate piece of work to make one general investigation, which does not take long, and then use approximate values close enough for all practical work. J. S. BRANNE,
Consulting Engineer.
New York City.

SIR: The recent article by Mr. Fleming on eccentric loading should have the effect on its readers of clearing up some popular misconceptions on this subject. On page 287 of the 1916 Carnegie Steel Handbook, as well as in various other steel handbooks, is found an analysis of this problem which gives results that are incorrect, although on the safe side.

There seems to be no logical excuse for any formula which makes the factor of safety a factor of ignorance. In extreme cases which seldom occur in practice these formulas in the "Carnegie" give results only a little on the safe side. The large majority of columns eccentrically loaded in this fashion have a factor of ignorance of almost twice the assumed factor of safety.

The formulas given in Mr. Fleming's article are easy to follow and well deserving attention from the designer. Should not such formulas be stated in any handbook upon which many designers lean for the moral support of their calculations? Should not every designer know that the eccentric bending moment developed in the sketch on page 287 of "Carnegie" is carried by sections both above and below the point of application of eccentric load, instead of being carried entirely by one section, as is there stated?

It seems to the writer that two advantages would result from a correct statement of this matter in handbooks. First, the designer would have a clearer idea of the manner in which any column acts to resist bending due to eccentric loading. Second, the responsibility for the safety of a structure would rest a little more with the designer and a little less with the much-abused factor of safety. G. A. MANEY,
University of Minnesota.
Minneapolis.

Manufacturers Should Tell What Parts Wear Out First

SIR: Yellowstone Park is in the midst of the Rocky Mountains and just about 1000 miles from any considerable center of trade, manufacture or labor. Hence we probably feel more the necessity of keeping on hand parts of machinery that are likely to break or wear out than most users of machinery. As in all modern road construction, we are fast acquiring quite a varied and extensive line of machinery, and it is only by a lavish use of the telegraph, express and parcel post that we are enabled to keep going.

It has often occurred to me that it would be an enormous help if every manufacturer of machinery would publish for each machine a list of the parts that wear out quickest and break oftenest, so that the user could carry those parts in stock in the necessary quantities to insure him of reasonably continuous operation; it ought also to increase the sales of such machines. For instance, we have been operating for two seasons a 5-ton White truck, and the nearest point from which supplies can be obtained is Cleveland, some 1500 or 1600 miles distant. The truck is a remarkably good one, but we have had occasion several times to order small parts that were absolutely essential; and as they have to come from such a distance, it takes nearly a week to get them even when using the telegraph and express.

In fact, had we not been able to borrow a couple of times from other owners of the same truck, we would have had several days' delay, and each day's delay costs us about $50. In a number of cases we have asked the manufacturers when purchasing machinery what parts were most likely to break or wear out and should be carried in stock, and never, except in one instance, did we get any information on the subject. Certainly, where a hundred or more machines have been in use over a period of two years it ought to be easy to develop a list of parts that wear out or break, so as to show the probabilities of such breakage, and thus enable the owner to keep on hand a reasonable stock of spare parts.

I believe this subject worth the attention of your paper, for the loss of time and efficiency resulting from even a day's or half day's delay will amount to far more in one season that the cost of extra supplies, even to the man who has only a few miles to go to get spare parts. Amos A. Fries,
Major, Corps of Engineers, U. S. A.
Yellowstone Park, Wyo.

Is State Insurance Accident Prevention?

Sir: In your issue of Aug. 26, page 248, appears an editorial entitled "Is State Insurance Accident Prevention?" In it you make quotations which indicate that state insurance tends toward carelessness on the part of employers and that private insurance tends toward making the employer more careful. You also draw the conclusion at the end that private insurance seems to form the method for obtaining less accidents and lower rates of insurance.

As a member of the State Insurance Fund of Pennsylvania I cannot agree with either the quotations or your conclusion. Last fall the stock companies, when in conference making up their proposed rates for the year, added to the net cost of insurance losses about 42 per cent for expenses, leaving 58 per cent to be paid for the losses. The state fund has not had such a percentage of expenses. The state fund of this state, and I believe of other states, is just as active in following up and insisting upon the adoption of safe and careful methods in industries insuring with it as are private companies.

The state fund has its corps of inspectors exactly as have private companies, and in addition it has the advantage of very close relations with the state inspectors of the labor department. The state fund is not, in Pennsylvania, or in most states, intended to be a monopoly, nor should it become so. The theory of its creation is based upon the need on the part of the authorities to have accurate information as to what the cost of losses and expenses should be, in order that the state authorities may insist that private companies charge reasonable rates. The result in this state has been that our authorities have had valuable information as to the costs of operation and as to loss costs always available from the state fund. On the other hand, although the authorities have the power under the law to gather such information from the private companies, by some means or other such information has not been obtainable either promptly or in satisfactory form. Without such information the authorities cannot determine reasonable rates. The state fund furnishes such information both promptly and accurately. The state fund, further, shows the possibilities as to what can be required with regard to promptness of loss payments, and concerning various other items of administration which are essential to effective compensation systems.

I am personally a very warm advocate of having our business carried on by private industry and initiative, and for that reason I should deeply regret any move in our state, or any other state, which was in the line of making a monopoly of the accident-insurance business. On the other hand, I am equally convinced, by reason of the facts and experiences which have been forced upon me in the last year, that a state insurance fund, properly handled and carried on in such a way as not to become a monopoly, is a most essential element in the efficient development of the compensation system. John Price Jackson,
Commissioner, Pennsylvania Department of Labor and Industry.
Harrisburg, Pa.

Inconsistencies Shown in Water and Sewer Laws

Sir: In an article in your issue of Sept. 2, page 284, by W. L. Butcher, entitled "Inconsistencies Shown in Water and Sewer Laws," I notice a statement to the effect that in Pennsylvania communities are expressly prohibited from charging annual rentals or maintenance cost for the use of the sewers.

I am inclosing herewith a copy of an act of the General Assembly, approved May 11, 1915, authorizing boroughs to collect an annual rental or assessment from property abutting on sewers constructed at public expense and providing for the collection thereof. Please notice that Section 4 specifically states that the rental may include the cost of maintenance, repair, alteration, inspection, and the interest charges on money expended in the construction of the sewer or sewer system. C. A. Emerson, Jr.,
Acting Chief Engineer, Engineering Division, Pennsylvania Department of Health.
Harrisburg, Pa.

An Act authorizing boroughs to collect an annual rental or assessment from property abutting on sewers constructed at public expense, and providing for the collection thereof.

Section 1. Be it enacted, etc., That whenever any borough of the Commonwealth of Pennsylvania has heretofore constructed, or shall hereafter construct, any sewer or sewer system, at public expense, the council of the said borough may provide by ordinance for the collection of an annual rental or charge, for the use of such sewer or sewer system, from the owners of property served by it. Such annual rental or charge shall be authorized and collected as provided by general ordinances, and when so levied and charged shall be a lien on the properties charged, and the collection thereof shall be made and enforced in the manner borough taxes are now collected.

Section 2. The councils of said boroughs shall execute a warrant, or warrants, authorizing the collection of the said annual sewer rentals or charges, to the officer employed by council to collect the same, and the officer collecting the said rentals shall have the authority now vested by law in collection of borough taxes.

Section 3. The said annual sewer rentals or charges shall be lien on the properties charged with the payment thereof, from the date set in the said ordinance, and if not paid after thirty days' notice may be collected by an action in assumpsit, in the name of the borough, against the owner of the property charged, or by distress of personal property on the premises, or by a lien filed in the nature of a tax lien.

Section 4. The said annual rental, so to be levied and charged as herein provided, shall not exceed the amount expended annually by the said boroughs in the maintenance, repair, alteration, inspection, or other expense in relation thereto, and may include any interest on money expended by the said borough in the construction of the said sewer or sewer system. The said annual sum shall be apportioned equitably among the several properties served by the said sewers.

Hydraulic Flow Reviewed—A Correction

Sir: My attention has been called to a misstatement in my review of "Hydraulic Flow Reviewed," by Alfred A. Barnes, which appeared in the issue of Aug. 26, 1916, page 269. The statement reads as follows: ". . . not less than 3162 separate experiments being quoted." In making this statement, I was misled by the author's use of serial numbers. The number of experiments quoted and classified are as follows:

New asphalted cast-iron pipes	79
New uncoated cast-iron pipes	37
New asphalted screw-jointed riveted wrought-iron pipes	14
New asphalted single-riveted wrought-iron and steel pipes	16
New asphalted double-riveted wrought-iron and steel pipes	65
Clean lead pipes	24
Clean glass pipes	8
Clean planed wood troughs and new smooth wood-stave pipes	57
Clean unplaned wood troughs and new unplaned wood-stave pipes	123
Clean neat cement channels or pipes	33
Clean hard-brick well-pointed conduits	81
Clean smooth-faced concrete conduits	52
Dressed masonry channels in cement with no projecting surfaces	12
Rock-faced masonry channels in cement	17
Hammer-dressed dry masonry watercourses	27
Earth canals in average working condition and rivers free from vegetation	162

Summing up these experiments, it will be found that the number is 807 instead of 3162. A. G. Hillberg,
New York City. Hydraulic Engineer.

Bronze-on-Bronze Friction in Sluice Gates Tested

Sir: Since writing the article, "Bronze-on-Bronze Friction in Sluice Gates Tested," which was published in your issue of Sept. 9, page 330, I have ascertained the composition of the bronze used in the gates, a statement of which may add to the value of the article. The percentages were as follows:

	Gate Leaves	Frames
Copper	82.8	82.7
Lead	8.0	4.9
Zinc	4.4	5.3
Tin	4.8	7.1

D. C. Henny,
Consulting Hydraulic Engineer.
Portland, Ore.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

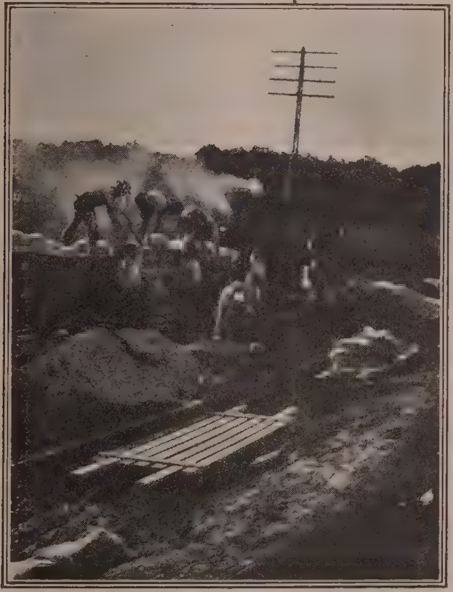
Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Handle Cement Safely and Cheaply on Plank Racks in Road Work

By HARLAN H. EDWARDS
Urbana, Illinois

THE RACKS plainly shown in the accompanying illustration have been found very convenient for handling cement sacks on the highway construction described elsewhere in this issue. These racks are made from seven 2 x 4-in. pieces, having the second and sixth sticks projecting about 2 ft. on each end to furnish handles for carrying the rack forward with the remaining cement sacks, if any are left over when the mixer is moved. The racks are kept raised from the ground by three 4 x 4s nailed across the bottom. In wet weather and at night the cement piled on these racks is covered with tarpaulin, which affords complete protection from moisture.



PLANK RACKS KEEP CEMENT DRY

Mixer Train Handles Gravel from Hopper Cars on Belt Conveyors

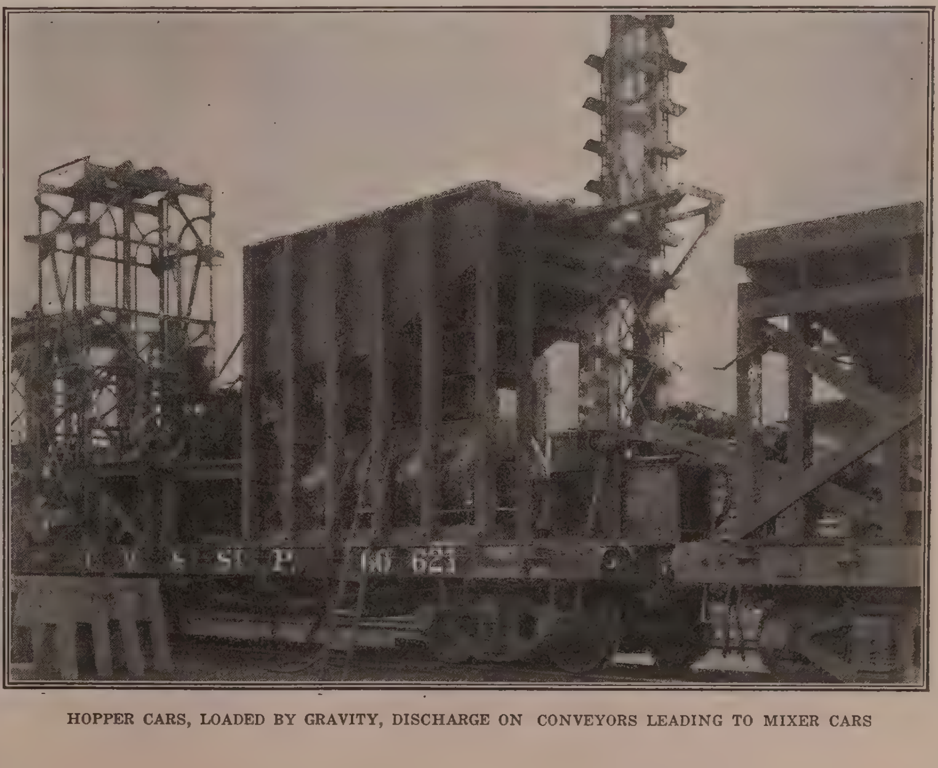
By W. A. KELLNER
Office Engineer, Chicago, Milwaukee & St. Paul Railway Company

A CONCRETE train in service on the Chicago, Milwaukee & St. Paul Railway carries its aggregate in two cars which are filled by gravity from large storage bins and which discharge into the hopper on the mixer car by means of belt conveyors and a bucket elevator. On the mixer car is mounted a collapsible tower with two bucket hoists for discharging concrete into the forms. The plant, which was designed primarily for tunnel work, and which is at present engaged in lining the central portion of a long tunnel, is entirely operated by compressed air supplied through a pipe line to the point of work.

The gravel cars, which are interchangeable, were made by constructing on standard 42-ft. flat cars bins subdivided into five pockets, which are hoppered in all four directions. At the bottom of each pocket is a gate and chute for discharging aggregate upon 16-in. troughed belt conveyors, one of which extends the full length of each car and has a capacity of 30 yd. per hour. Each of these conveyors is raised at the head end of the car so as to overlap either the next conveyor or the boot of the elevator on the mixer car, depending on the position of the gravel car in the train. These overlapping ends of the conveyors are carried on hinged frames and can readily be raised up by means of small winches so as not to project beyond the ends of the cars. Both of these conveyors and the bucket elevator are run through a series of chain drives by an air motor on the mixer. This drives the bucket elevator, which loads the bins over the mixer, by means of a chain and sprockets. The chains which connect the sprocket on the boot shaft of the bucket elevator with that on the forward end of the conveyor on the next car, and which connect the sprocket at the rear end of this conveyor with the forward end of the conveyor on the last car, can be quickly removed for switching and replaced when the train is in position for concreting.

The concrete mixing and placing plant is mounted on a third standard 42-ft. flat car. It consists of the gravel bucket elevator, which is collapsible and has a capacity equal to that of the belt conveyors, a 100-cu. ft. compressed-air receiver, the 8-hp. air motor operating the conveyor system, a 13-cu. yd. gravel storage bin, a No. 1 chain belt concrete mixer with power loader and engine, and the collapsible concrete elevating tower which is equipped with two 1/3-yd. pivoted self-dumping elevator buckets and with air hoists for operating them. The power loader of the mixer is charged by gravity from the bin, and cement is supplied from a box car coupled in front of the mixer car. Water is supplied through a pipe line laid in the tunnel. The mixer discharges into a chute from which concrete may be directed into either one of the elevator buckets. These buckets are raised at the top of the tower and

TWO HOISTS SERVE EITHER SIDE WALL



HOPPER CARS, LOADED BY GRAVITY, DISCHARGE ON CONVEYORS LEADING TO MIXER CARS dumped into chutes leading to the side-wall forms by drums and cables operated by the cylindrical air hoists. The mixer engine, the elevator motor and the bucket hoists are all supplied with air from the receiver, which is connected through a hose to the air line extending into the tunnel from the compressor plant at the portal.

The carrying capacity of the plant provides for two hours' continuous concreting, as it is used only between train movements. The gravel cars are loaded at the tunnel portal from overhead bins with a selected pit-run gravel from which the coarse material has been screened. The plant, with the cement car, is then moved into the tunnel and spotted by a locomotive, which is immediately withdrawn. The chain drive of the conveyor system is then connected, together with the water and air lines, and the plant is ready for operation. About 500 cu. ft. of free air per minute at 80 lb. pressure is required for its operation. An average output of 20 to 24 cu. yd. of concrete per hour is realized, with a maximum output of 26 cu. yd. A force of thirteen men is required.

The plant, which was designed by the engineering department of the Chicago, Milwaukee & St. Paul Railway, of which C. F. Loweth is chief engineer and H. C. Lothholz engineer of design, has been in continuous use for about a year in lining the central portion of the 8800-ft. St. Paul Pass tunnel in the Bitter Root Mountains. The pneumatic process is being used for lining the ends of the tunnel.

Trusses Changed for Girders Without Falsework

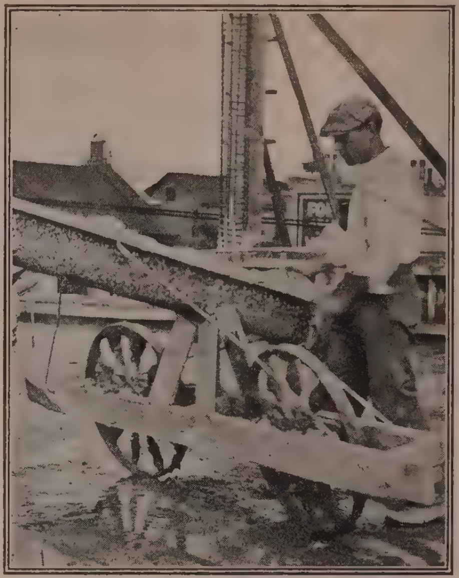
By C. L. KETCHAM
Pleasanton, Kan.

TWO through-truss spans have recently been replaced by four deck-girder spans and dismantled without the use of falsework in the river in reconstructing the 306-ft. bridge of the St. Louis & San Francisco Railroad over the Grand River in Oklahoma. The new girder spans were handled by the carrying cars built by this railroad for bridge reconstruction and described in the Engineering Record of May 6, 1916, page 622. Before these cars, carrying a new girder span, were run out on the old bridge, all rivets had been replaced with bolts in the old floor system between the old and new piers prepared to carry the deck-girder span. While the new span hung suspended from the cars, the track beneath it was torn up, the bolts removed and the old floor system lowered to scaffolding hung from the old trusses. As soon as this was out of the way, the carrying cars lowered the new span in place and the track was again connected across it. The greatest length of time track was blocked in making the change with any of the four girder spans was one hour and thirteen minutes.

Each of the new spans was 77 ft. long and weighed 50 tons. When two of them had been set inside one of the old truss spans heavy cross-timbers secured underneath the girders by hanger rods were placed under the panel points of the old span and used to support it during dismantling. The entire change was made at a labor cost of about $1400, which is probably less than the cost of falsework alone for the ordinary method. Moreover, two floods occurred during the work which were large enough to have swept away any falsework that might have been placed in the river.

Chute Rides "Bicycle" Around Building Floor

THE ACCOMPANYING photograph shows a handy rig made in less than an hour out of a pair of wheels from an old concrete buggy and a few planks and reinforcing rods, used to ride the end of the concrete chute around over the area being poured, and christened a "bicycle" by T. J. Wallenta, superintendent for the Malkin Construction Company, of Memphis, who made it. As will be observed from the photograph, the "boxes" of this vehicle are carefully covered with pieces of plank to prevent them from being filled with grout. The machine saves proportionally a great deal of labor over the ordinary practice of using small wooden horses, which were at first employed on this building, as anyone can appreciate who has watched four or five "hunkies," ankle deep in concrete, clustered around the end of such a chute in an effort to raise it and carry it to a new position. It is so easy to move the chute that the concrete can be put directly in place with little trouble, and the shoveling required is considerably reduced.

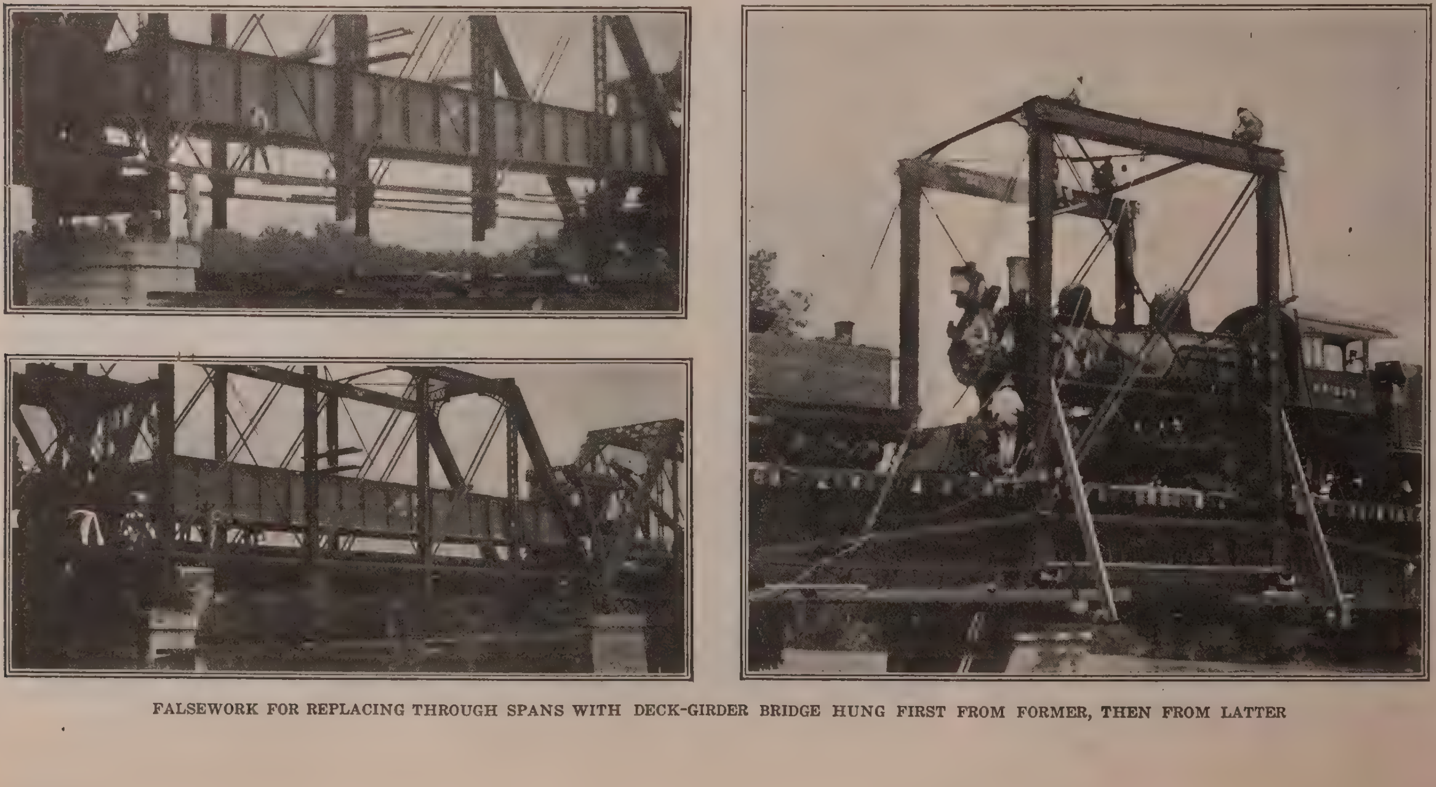


"BICYCLE" CARRIES END OF CHUTE

The device is being employed in pouring the floor slabs in the Overland Building at Memphis.

New Zealand Railways Develop

According to a statement by the minister of railways, there were on March 31, 1916, 2970 miles of railway in New Zealand, compared to 2955 miles at the end of the previous year. The construction cost of these lines at the close of the past fiscal year was $181,691,167, with gross earnings of $22,134,574, compared to a revenue of $19,979,206 for the previous fiscal year.



FALSEWORK FOR REPLACING THROUGH SPANS WITH DECK-GIRDER BRIDGE HUNG FIRST FROM FORMER, THEN FROM LATTER

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Thacher Patent Invalid Declares Iowa Court

Judge of District Court Rules There Was No Infringement—No Action Brought Until Long After Patent Was Issued

Judge Wade, of the U. S. District Court for Southern Iowa, on Sept. 12 dismissed the case of Thacher vs. the Board of Supervisors of Polk County, Iowa, et al, in which the defendants were sued for infringement of Thacher's patent (U. S. Patent No. 617,615) for concrete-arch reinforcement. Judge Wade's opinion agrees with the previous ruling of Judge Rose in the Baltimore case (see Engineering Record of Feb. 26, page 274) that the patent to Von Emperger embodies the idea upon which the Thacher patent was issued, but holds that the Von Emperger patent was actually in anticipation. He also holds that the proof furnished to the patent office to establish the fact that Thacher's invention antedated the Von Emperger patent is not sufficient, with the evidence in this case, to justify sustaining the patent, which is exactly contrary to the finding of Judge Rose.

The opinion agrees with a decision by Judge Thomas that the Thacher patent is specifically limited by the language "each bar of a pair being independent of the other." It states that there was no infringement in this case, as the bars used in the construction in issue are a part of a rigid or semi-rigid structure consisting of longitudinal rods with transverse and lattice bars all firmly bound together by wire ties at intersections in such a manner that they act together. It is held on the evidence given by Dean Marston, of the engineering college of Iowa University, that the element of independence of each bar upon which the patent was secured is not present in the structures considered.

No Infringement, Judge Says

"Without further discussion of the evidence," the judge continues, "I am convinced that there is no infringement in this case. I am also of the opinion that the plaintiff is estopped by laches from asserting any such construction of his patent as would bring the structure involved in this case within its meaning.

"This patent was issued in 1899; it expired before this case was tried. During all the years from the issuance of the patent up to the present, the plaintiff has been in close touch with concrete construction all over the United States. For years bridges and other structures have been erected which come as near infringing the plaintiff's patent as do the structures in controversy, and no action was ever brought by the plaintiff until 1913 and 1914—fourteen or fifteen years after the issue of his patent.

Protest Filed Just Before Patent Expired

"The plaintiff permitted individuals and municipalities to proceed apparently in good faith, with private and public work, and made no protest until a comparatively short time before his patent expired. In fact, I am convinced that the plaintiff's present view of the construction of his patent as including structures such as those in controversy is a discovery made by him or some one else within recent years. I do not believe, during all these years when he quietly allowed those he now claims to be infringers to proceed without asserting any right, that he understood or believed that these structures came within the claims of his patent."

The bill was therefore decreed dismissed with judgment against the plaintiff for costs.

Break in Pipe Causes Flood in New York Tunnel

Opening of a joint Sept. 26 in the bend of a 20-in. water main under the Steinway tube, near Forty-second Street and Park Avenue, New York City, caused a flood of water which delayed traffic for several hours. No lives were lost, no injuries sustained and little damage was done.

The cause of the opening of the joint has not yet been definitely decided. The pipe was laid by the Department of Water Supply, Gas and Electricity after the contract was let. The contractor claims that the work was defective. The theory has also been advanced that overhead traffic loosened the lead calking in an elbow of the pipe.

National Safety Council to Meet at Detroit October 17 to 20

A typographical error in last week's issue caused the news item on the meeting of the National Safety Council to read as though the convention had taken place. As was evident, despite the error, the event will take place next month.

Fire and Accident Prevention Day to Be Observed October 9

The National Fire Protection Association and the National Safety Council are uniting this year in urging the nation-wide observance of fire and accident prevention day on Oct. 9, the anniversary of the great Chicago fire. A poster has been designed and suggested programs of observance of the day worked out. This is the first organized attempt to promote the general observance of fire-prevention day throughout North America.

Paving Brick Men Meet October 5 and 6

The notice of the annual meeting of the National Paving Brick Manufacturers' Association as announced in the Sept. 2 issue was not clearly stated. The convention will be opened Oct. 5 in the Deming Hotel at Terre Haute. The following day (Oct. 6) will be devoted to inspection trips and construction demonstrations.

New York Board of Appeals Inaugurates Bulletin

The Board of Standards and Appeals of New York City published last week the first issue of the regular bulletin required by law. The object of the journal is to keep the public informed as fully and promptly as possible of all rules adopted by the board and of other action in regard to building requirements in the city. The bulletin will be issued weekly, each issue to contain announcements, notices of hearings to be held and of tests to be conducted under the board's supervision; rules, amendments and repeals made by the board; every order, requirement, decision or determination relating to the construction, alteration, equipment or occupancy of buildings; minutes of meetings; the calendar of the meeting following and other matters of interest bearing upon the work.

The bulletin is issued for free distribution. Rudolph P. Miller is chairman and Daniel Sullivan secretary of the board, with offices in the Municipal Building. Meetings will be held Thursday afternoon of each week, and all will be open to the public.

Testing Society Adopts Revised Standards

Standard Cement Specifications Among Those Accepted as Result of Letter Ballot—Become Effective January 1, 1917

Among the list of proposed standards, all of which were adopted as a result of the required letter ballot of the American Society for Testing Materials canvassed Sept. 1, are the revised standard specifications and tests for Portland cement. By action at the last annual meeting (see Engineering Record, July 8, page 59) these will not become effective until Jan. 1, 1917. The executive committee will consider certain changes in form, as distinguished from substance, at its next quarterly meeting, to be held Oct. 10.

Through the adoption of the amendments to the by-laws the publication of the year book has been discontinued, and instead a biennial publication, beginning this year, and called the "A. S. T. M. Standards," will be inaugurated. The 1916 volume, which will contain about 800 pages, is expected to be ready by the end of October, at a list price to nonmembers of $7.50 in cloth binding.

New Dallas (Texas) Terminal Opened

The new $5,000,000 union passenger terminal at Dallas, Tex., was recently opened to the public. Its design and features are about the same as of the one at Kansas City.

Reading Opens New Bridge Over Susquehanna at Milton

The new bridge of the Philadelphia & Reading Railway across the Susquehanna River at Milton, Pa., was opened for traffic Sept. 10. The construction of the bridge was described in the Engineering Record of May 20, page 676.

Lack of Road and Concrete Contractors

That Kentucky has not enough road contractors or contractors capable of doing good reinforced-concrete work is the belief of Rodman Wiley, state road commissioner. "I think it would be well," he states, "for contractors to investigate the prospects in Kentucky."

Think Quicksand Would Render Hydraulic Grading Unsafe

Because of quicksand discovered in considerable quantity along its right-of-way, the New York, Chicago & St. Louis (Nickel Plate) Railroad believes the proposed use of the hydraulic method of excavating 750,000 cu. yd. of material along its tracks between Detroit Avenue and Fulton Road, in connection with grade-crossing elimination on the West Side in Cleveland, would endanger adjoining buildings. The company has therefore asked that it be allowed to use steam shovels instead, and place the material alongside its tracks east of Cleveland instead of sluicing it into Walworth Run, as contemplated.

The city has refused to sanction the change, inasmuch as the railroad had agreed to fill Walworth Run, and to make the projects possible the municipal electric-lighting plant had spent $40,000 carrying power to the motors that were to operate the pumps. The waterworks had also laid a 30-in. main to carry the 7,000,000 gal. of water daily to the excavation. The matter is still pending.

The cost of eliminating the grade crossings is estimated at $2,100,000, of which the city is to pay $765,000.

Commercial Organization Offers Prizes to Engineers

Three honorariums, $50, $30 and $20, are offered by the engineers' subdivision of the Chicago Association of Commerce for the three best papers, not to exceed 3000 words, on any one of the following subjects: (1) "Engineering and Civic Progress," (2) "The Engineer of the Future," (3) "The Business Relation of the Engineer to the Commercial World." The contest is open to undergraduates and graduates of any recognized school of engineering in the United States during the years 1915 and 1916.

Relationship of the engineer and of engineering to the business and professional world, how best to realize the conceived ideal of engineering, concrete examples illustrative of the true significance of engineering, such as a brief prospectus of a proposed work or a short, crisp, readable news article on a piece of engineering construction, are suggested lines for development.

The judges of the relative merits of the papers will be F. H. Newell, professor of civil engineering, University of Illinois; John W. Alvord, consulting engineer, Chicago, and John F. Hayford, director, College of Engineering, Northwestern University.

All papers should be mailed to the Chicago Association of Commerce, Otis Building, marked "Engineers' Subdivision Contest," and must reach there not later than Nov. 1, 1916.

A Forest of Signals

Among the many wild and ignorant statements made on the floor of Congress during the "consideration" of the "eight-hour" law and during its subsequent defense by democratic members, the blue ribbon should undoubtedly be awarded to one by Senator James A. Reed of Missouri, which is worth repeating as illustrating the amount of information on the subject possessed by some "statesmen" who voted for the bill. He says:

"I talked with a man who is manifestly more than half a nervous wreck. He used to pull the Twentieth Century Limited between Chicago and New York. He told me that by actual mathematics it could be demonstrated that upon that run the engineer holding that throttle had to read and record in his own brains six signals every second. Eight hours a day is long enough for that kind of labor. Eight hours is long enough for the passengers to ride behind a man under that kind of a strain."

We do not blame the Senator for becoming excited about the six signals per second, but a little "actual mathematics" would have shown him that a train running 60 miles an hour traverses 88 ft. in a second, and he is doubtless enough of a traveler to know that the scenery along the New York Central is not obscured by a signal every 14 ft. The artless credulity shown by statesmen of the Reed and La Follette type when they are talking to members of the labor unions is only equaled by the impossibility of getting into their heads a single real fact or truth regarding railway matters.—*Railway Age Gazette.*

Develop New Set of Formulas for Flow in Wood-Stave Pipe

A new highly technical bulletin on the flow of water in wood-stave pipe has been prepared by F. C. Scobey, irrigation engineer in the U. S. Department of Agriculture. The work is based on results obtained through experiments on the flow in wood-stave pipes from 8 to 13½ in. diameter. From the results of all experiments a new set of formulas for the flow of water in stave pipes has been deduced. These are also printed in the booklet. Engineers may obtain copies of the volume—Bulletin 376—by request to the Agricultural Department, Washington.

Engineering Society to Bring Out Popular Engineering Magazine

A magazine to advertise the work of the engineer among men who are not engineers is the purpose of a journal the Cleveland Engineering Society is bringing out with the assistance of eleven other organizations. The idea is to get distribution through engineering schools and societies. Fifteen universities and thirteen societies are on the list of distributors. More are desired and must send in their orders early, as the edition will be limited. The copies are 25 cents each and will contain 100 pages, two-thirds of which will be pictures.

The tentative table of contents includes the names of Prof. F. H. Newell, University of Illinois; Prof. George J. Johnson, Case School of Applied Science; S. W. Stratton, U. S. Bureau of Standards; Prof. H. S. Jacoby, Cornell University; Rudolph Hering, consulting engineer; A. W. Johnson, New York Central Lines, and Clemens Herschel, president of the American Society of Civil Engineers.

The organizations which have expressed a desire to help with the magazine are as follows: American Society of Mechanical Engineers; Engineers' Club, Dayton; Civil Engineers' Society, St. Paul; Detroit Engineering Society; Engineers' Club, Baltimore; Engineering Association of the South; Washington Society of Engineers; Kansas Engineering Society; Ohio Engineering Society; Engineers' Club of St. Louis and American Association of Engineers.

National Educational Association to Draft Standards for School Planning

The schoolhouse standardization committee of the National Educational Association will, Oct. 2, issue its first bulletin calling attention to the waste and lack of system in schoolhouse construction.

The committee appeals for information from all local authorities with the view of determining those standards which pertain to schoolhouses and which have already been accepted by states, cities and trade organizations and by the educational boards. From these returns it hopes to draft standards for school planning to be reported to the next meeting of the association.

Charged with Using Pennsylvania State Labor to Do Farm Work

Charges of using state-paid laborers to do work on his farm have been filed against H. E. Miller, road foreman, by Arthur S. Clay, assistant engineer in the Pennsylvania Highway Department. The accused man, who had charge of the repair of state highways in the vicinity of Butler, has been arrested and, with his assistant, suspended from service.

An Important Correction

In the obituary notes of last week's issue was a paragraph on F. L. Clapp. Too late to prevent publication of the article, it was discovered that an error had been made in its preparation. The F. L. Clapp who died is not the engineer of that name who is well known to technical men in the East and whose biography was published. The names of the two men were the same and even the initials identical. Furthermore, the two engineers were both located in the neighborhood of Boston and engaged in the same fields. In preparing the note the activities of the Messrs. Clapp were not correctly recorded. This explains the confusion of the two men's biographies, but in no way expresses the Engineering Record's regret for the occurrence. The biography given in last week's issue therefore represents the activities of Frank Lemuel Clapp, formerly of the New York Board of Water Supply, and now with Fay, Spofford & Thorndike, consulting engineers, of Boston, who is "very much alive."

Would Make Top Deck of Eads Bridge at St. Louis Free

Electrification of the Eads Bridge over the Mississippi River at St. Louis and the tunnel under the business section of the city, which is owned by the Terminal Railroad Association, and the construction of three downtown underground suburban stations are advocated in the annual report of the director of public utilities. The cost, estimated at $1,000,000, would be borne by the railroads, in return for which the railroads would be given the use of the free bridge. The upper deck of the Eads Bridge would then be turned over to the city for a consideration, the toll of 5 cents for pedestrians would be abolished and street-car fare would be reduced from 10 to 5 cents. The plans have been made by C. E. Smith, consulting engineer of the Department of Public Utilities.

Engineering Society Activities

The Harvard Engineering Society of New York will hold its first fall meeting this evening at the Harvard Club in that city, following an afternoon visit to the Hell Gate bridge. H. W. Hudson, construction engineer on the bridge, will give an illustrated lecture on that work.

The Engineers' Club of St. Louis held a meeting Sept. 27 at the Planters Hotel in connection with the convention of the Smoke Prevention Association. John J. O'Connor, Jr., of the University of Pittsburgh, presented an illustrated paper on soot fall studies.

The Efficiency Society of America will hold the annual session of its trustees and board of direction Oct. 7 and 9 at the Hotel McAlpin, New York City.

The Engineers' Society of Western Pennsylvania, at its Sept. 26 meeting, heard Patrick Mullen, mine inspector for the H. C. Frick Coke Company, discuss new mining methods as practised by his firm.

The Brooklyn Engineers' Club will hold its regular meeting Thursday, Oct. 12. G. Laurence Knight, of the Edison Electric Illuminating Company, will read an illustrated paper on construction of foundations for large turbo-generators and other apparatus under difficult subsurface conditions.

The American Society of Mechanical Engineers' New York section will meet Oct. 10. Dr. C. L. Reese, chemical director of E. I. du Pont de Nemours & Co., will lecture on explosives, giving special attention to their use for industrial purposes. A dinner will precede the meeting.

The American Association of Engineers will hold its second annual booster dinner in Chicago at the City Club Oct. 6. C. Francis Harding, professor of electrical engineering at Purdue University, will give the principal address on "Marketing Engineering Ability." John Ericson, city engineer, will tell of his experiences in hiring engineers. W. H. Finley, chief engineer, Chicago & North Western Railway, and Isham Randolph, consulting engineer, both members, are on the program.

The Western Society of Engineers was addressed Sept. 25 by Clinton B. Stewart, consulting engineer, of Madison, Wis. B. E. Grant, president, announced that the board of direction had elected D. W. Roper, formerly second vice-president, to the first vice-presidency to fill the vacancy caused by the death of C. H. Cartlidge. H. J. Burt was elected to fill Mr. Roper's place. The society has become a member of the Chicago Association of Commerce, as the board had felt the necessity of closer relations with business interests in private as well as civic affairs. Prof. C. T. Johnston will speak Oct. 2 on "The Engineer and Public Service."

What Engineers and Contractors Are Doing

W. F. FOURRIER has been made assistant engineer of the Atchison, Topeka & Santa Fé Railway's coast lines, with headquarters at Needles, Cal. He succeeds B. H. Quinlan, resigned.

A. T. HARDIN, vice-president of the New York Central Railroad, has been made vice-president as well of the Michigan Central, the Cleveland, Cincinnati, Chicago & St. Louis and the Ottawa & New York railways. Mr. Hardin is an engineer and advanced through the maintenance-of-way department of the New York Central, being engineer maintenance of way from 1903 to 1905

GERALD BAGNALL, who for the past 16 years has been assistant engineer in the second Portland district of the War Department, with headquarters at Portland, Ore., has been transferred to Kansas City. Mr. Bagnall will be assistant in the office of Lieut.-Col. James F. McIndoe, who is directing the Missouri River improvement work. Mr. Bagnall has had many years' experience on Mississippi River projects and has also been in the government service at Galveston. During the years spent in the Portland district he has been identified with jetty construction at the mouth of the Columbia River as well as with channel work there and in the 108 miles of river between Portland and the sea. As the north jetty will be finished next year and the new work will consist principally of the construction of dikes and permanent improvements in the river, it is believed that no appointment will be made to fill Mr. Bagnall's place.

R. P. BOYD, formerly assistant state highway engineer of Alabama, is now associated with James W. Billingsley, consulting engineer, of New Orleans. He will have direct charge of $400,000 worth of gravel road construction in Ouachita parish.

J. B. CONVERSE, of Selma, Ala., succeeds R. P. Boyd, whose resignation as assistant state highway engineer of Alabama is noted in this issue.

FRANK P. KEMON, superintendent of construction for the Robert Grace Contracting Company, has been transferred from Harrisburg, Pa., to Crown Point, Ind. His firm has 40 miles of new line under construction near that point for the Erie Railroad, on which Mr. Kemon will direct the concrete work.

C. C. CARPENTER, formerly in the employ of McArthur Brothers Company, is now with the Robert Grace Contracting Company. He is directing work on the contract his firm has with the Erie Railroad for a bridge near Johnson City, N. Y.

W. W. EWING, special investigator for the U. S. Bureau of Foreign and Domestic Commerce, recently visited Cincinnati as a guest of the Chamber of Commerce of that city. As has been noted in the Engineering Record, Mr. Ewing, who is an engineer and has had extensive experience with international engineering and equipment companies, will leave next month for South America. He will gather material for an exhaustive report on markets for construction materials and machinery in the countries he intends to visit. Mr. Ewing has completed his tour of large manufacturing cities of the United States, which he made to confer with American companies.

H. A. LANE has been promoted from assistant engineer of surveys to assistant to the chief engineer of the Baltimore & Ohio Railroad. Mr. Lane entered the railroad engineering field in 1895 as rodman on the engineering corps of the New York, New Haven & Hartford Railroad. In 1901 he was made assistant engineer in charge of the northern half of improvements for the abolition of grade crossings at Fall River, Mass., a work costing $1,600,000. He entered the employ of the Baltimore & Ohio in 1902 in the office of the assistant engineer of surveys. In 1907 when that road began its campaign for the betterment of its line, Mr. Lane was given charge of operations for freight terminal betterments. He was made assistant engineer of surveys in 1910, in which capacity he remained until his recent promotion.

JOHN V. SPRAGUE, who has been connected with the engineering department of New Haven, Conn., for the last four years, has resigned, effective Oct. 1. For the past year he has been in charge of the office and field work of the bureau. He has resigned to become associated with Thomas F. Maher, a local paving and sewer contractor. The new company has opened offices in the Chamber of Commerce Building. Mr. Sprague is a graduate of Trinity College.

C. B. MCCULLOUGH has resigned as assistant chief engineer of the Iowa highway commission to take charge of the course in structural engineering at the Oregon Agricultural College. Since his graduation from the Iowa State College in 1910 Mr. McCullough has spent most of his time in the employ of the Iowa commission. As its designing engineer he had charge of the preparation of nearly all of the standard concrete designs now in use. Since May, 1915, he has held the position of assistant chief engineer in charge of concrete pavement investigations and experimental road work.

W. L. DARLING has resigned as chief engineer of the Northern Pacific Railway effective Oct. 1. He has, with the exception of a few years, been connected with the Northern Pacific since 1889. He acquired his first railroad experience with the same road in 1879. His plans for the future have not been announced.

H. E. STEVENS, formerly bridge engineer of the Northern Pacific Railway, will succeed W. L. Darling as chief engineer Oct. 1 Mr. Darling's resignation is noted elsewhere in this issue.

F. H. TILLINGHAST and **W. PARKER IRELAND** have formed the engineering firm of Tillinghast & Ireland, consulting and constructing engineers, with offices in the Forum Building, Sacramento, Cal., and the Nixon Building, Reno, Nev. They will practise irrigation, drainage, hydraulic and sanitary engineering. Mr. Tillinghast has been in the employ of the U. S. Reclamation Service for the past twelve years in charge of construction of irrigation works, the most recent of which is the Lahontan dam of the Truckee-Carson project in Nevada. He was graduated from Brown University in 1899, after which he took a postgraduate course in hydraulics at Massachusetts Institute of Technology. He spent a year with the Chicago Great Western Railway, and for a few months in 1901 practised in New York City, following which he was successively with the Choctaw, Oklahoma & Gulf Railroad and the Catawba Power Company. He joined the U. S. Geological Survey in 1902, but resigned two years later to become resident hydrographer in New York state and later in Washington, D. C. He joined the U. S. Reclamation Service in 1904. Mr. Ireland was formerly in the water department of Chicago, later hydraulic engineer with Puget Sound extension of the Chicago, Milwaukee & St. Paul Railway, and until recently constructing engineer with the State Engineering Department of California.

ERNEST B. HUSSEY, consulting civil engineer and president of the Engineers' Club of Seattle, has been appointed a member of the Seattle Community Trust Board, established to receive and disburse funds for charitable purposes.

A. J. FASBINDER has resigned as designing engineer for the Bollinger-Andrews Construction Company, of Verona, Pa., to take a similar position with the Carnegie Steel Company at Homestead, Pa. After graduation from the Copenhagen (Denmark) Polytechnic School in 1902 Mr. Fasbinder came to the United States, where for six years he was engaged in designing heavy mill and mining machinery and buildings. He spent the following three years in Mexico, devoting a large part of his time to a study of mining problems, after which he went to Tampico to direct refinery, pump-station and pipe-line construction. He returned to the East about two years ago.

LIEUT. D. D. GUILFOIL, Company A, Illinois Engineers, stationed at Camp Wilson, San Antonio, has resigned his commission and returned to his position of engineering salesman with Sauerman Brothers, Chicago.

H. A. MILLER, formerly with the construction department of E. I. Du Pont de Nemours & Company, Inc., at Hopewell, Va., has been made general manager of the Culpepper Granite Company, Buena, Va.

G. E. QUICK, formerly connected with the promotion department of the Universal Portland Cement Company at Chicago, is now superintendent for the M. J. Hoffman Construction Company of Evansville, Ind. Mr. Quick is located at Danville, Ill., where he is directing the erection of reinforced-concrete sheds for the new station of the Chicago & Eastern Illinois Railroad.

ROBERT LENNOX STEWART, who has been in charge of the New York office of the Casper Ranger Construction Company for the past year, has resigned to enter the employ of the Bridgeport office of the Austin Company.

Obituary Notes

FRANK E. SHEDD, vice-president and chief engineer of the engineering firm of Lockwood, Greene & Company, Boston, died in that city, Sept. 23. Mr. Shedd was born at Sharon, N. H., in 1856 and was graduated from the civil engineering department of Dartmouth College in 1880. The succeeding year was spent in topographic work with the U. S. Coast and Geodetic Survey, following which Mr. Shedd was, for four years, employed on general city surveys and construction at Lowell and Boston. During parts of 1886 and 1887 he was engineer for the contractors erecting the Washington mills at Lawrence, Mass. For the last thirty years he had been associated with Lockwood, Greene & Company since 1900 as vice-president. He had specialized in mill engineering and hydraulic work. Mr. Shedd was a member of many engineering societies and well known to engineers in New England.

Civil Service Examinations

New York City—Applications for position as assistant engineer will be received until Oct. 9 at room 1400 Municipal Building, New York City. Salary $1,200 to $1,350.

New York State—Examination Nov. 4 for junior assistant in engineering departments at salary $901 to $1,200. Address civil service commissioner at Albany.

United States—Approximately thirty vacancies in the Corps of Engineers, U. S. A., will be filled from candidates who pass an examination to be held about Jan. 29, 1917. All applicants who are not eligible for appointment as junior engineer in the engineer bureau of the War Department must take an examination to be held Oct. 11 and 12. Further information can be secured from the secretary of any civil service district.

Examinations Previously Announced

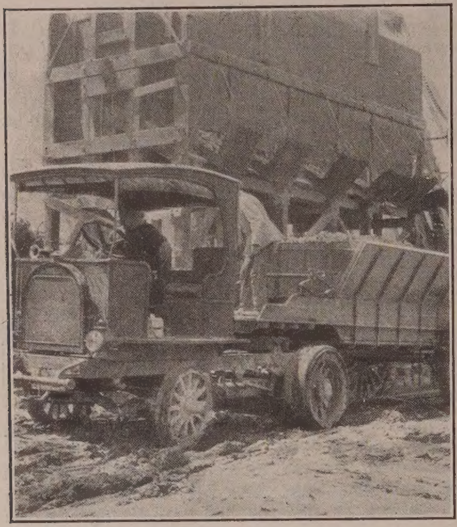
Date		See Eng. Record
Oct. 7.	Illinois junior highway engineer	Sept. 23
Oct. 11.	U. S. junior civil engineer	Sept. 16

Tractor and Trailer Turned in 31-Foot Circle

Flexibility in handling a motor tractor and trailer is probably one of the first requirements of contractors. This requirement, among others, is asserted to be fulfilled by the outfit shown in the picture. It is manufactured by the Watson Wagon Company, of Canastota, N. Y. The equipment has been tried for more than a year on heavy contracting work.

The tractor and trailer can be turned in a 31-ft. circle without backing. By backing only once the turn can be made in a 20-ft. circle. It is also claimed that the outfit can be turned on a 12-ft. roadway by a driver possessing ordinary skill. Another advantage of the short-turn feature is the leverage that can be brought to bear in pulling out of a hole.

The engine is supported by special springs on a subframe entirely independent of the main frame so that none of the trailer load comes on the special springs, which are designed to support only the constant weight of the engine, driver's cab and gasoline tank. The load on the main frame is carried by the usual set of heavy springs. This method of construction protects the engine and the vital parts of the car from undue vibration and shock.



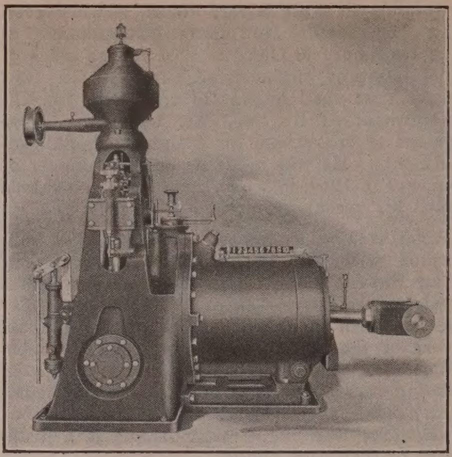
TRACTOR CAN BE USED WITH OTHER KINDS OF TRAILERS FOR HAULING LUMBER

Another feature of this new equipment is the distribution of the load, more than 60 per cent of which is carried on the steel tires of the trailer. The new equipment is constructed so that the standard trailer unit is a bottom dump, similar to the Watson bottom-dumping wagon, but much stouter and heavier. Trailers of the other design can be readily substituted for hauling lumber and other materials.

A New Waterwheel Governor

A new type of waterwheel governor, to be known as Type T, has been developed and recently placed on the market by the Lombard Governor Company of Ashland, Mass. Although this governor is primarily intended for direct connection to wicket-gate turbines, it may also be applied to cylinder gate wheels. It is built in all sizes from 3000 ft.-lb. output to 30,000 ft.-lb. output, this range making it applicable to all wicket-gate turbines up to 8000 hp. under 50-ft. head. For units requiring more energy to handle the gates a Type T actuator is used in conjunction with servomotors furnished by the wheel builders.

In the accompanying illustration the governor is shown arranged for direct connection to a horizontal gate shaft. It is also furnished with a sub-base which forms both a steady bearing and a support for a vertical gate shaft. The unit may be operated on either the open or the closed system and is driven by a novel design of rotary pump which may be either belt or motor driven. The pump is equipped with a special unloading valve.



NEW TYPE OF WATERWHEEL GOVERNOR

The makers claim that this governor is unusually steady under constant load, quickly regains equilibrium under sudden load change, and gives the same degree of speed regulation which is obtained with other Lombard governors of recent design. One of its outstanding features is that its foot-pounds of output may be very easily increased without changing the governor setting or altering the gate rigging or the governor connections thereto. The entire range of governor sizes is obtained with only two governor frames with the cylinders interchangeable.

Hauling Contractor Buys 50 Motor Trucks

What is asserted to be the largest transaction between an automobile manufacturer and a contractor took place recently when Stedman Bent, hauling contractor, of Philadelphia, purchased 50 White 5-ton trucks.

Mr. Bent is thought to be the first contractor to go into the motor-haulage field on such a gigantic scale. His efforts are backed up by carefully kept cost records, and he is surrounded by a staff of transportation experts who have worked out a system whereby the purchaser pays only for the actual work. He is prepared to do hauling of any nature by the day, week or month, or by the yard or ton, and in this way render service to any contractor, merchant or manufacturer.

The purchase of 50 trucks brings Mr. Bent's fleet to a total of 61, the first of which was bought in February of this year. In hauling dirt from cellar excavations Mr. Bent estimates that one of his trucks can do the work of nine teams, hauling three times as much on a single trip and making three or four times as many trips as a team.

CONTRACTOR WHO HAS 61 TRUCKS SAYS ONE DOES WORK OF NINE TEAMS

800 Miles Across Roadless Ground Made in 13 Days by Motor Truck

What is thought to be a new record in transportation annals has just been established by the U. S. Army truck train 13 in its overland run from Columbus, N. M., to San Antonio, Tex.

More than 800 miles were negotiated in 13 days' actual running time. Two days were spent in El Paso and two on the road, making the total elapsed time 17 days. With the exception of a stretch of about 30 miles leading into San Antonio, there was practically no road at all. The greater part of the route was across trackless desert, whose tractive surface was a thin sun-baked layer over the sand. Sometimes it was necessary for the men to build roads for the trucks of firewood taken from the chuck trucks. Fifty miles were made in this way. It was also necessary to ford streams and pull through long stretches of gumbo mud.

Through all these unfavorable conditions the train of 3-ton Riker trucks, built by the Locomobile Company of America, had to carry its own supplies, gasoline for the machine and subsistence and water for the men. The train was operating as an independent unit and could not secure supplies from any outside source.

Switzerland Wants Catalogs

The American consul at Geneva, Switzerland, advises the foreign trade committee of the Chicago Association of Commerce that a special room for catalogs of American manufacturers has been set aside in the new large quarters of the legation. Concerns interested are requested to supply late editions and data useful to commercial inquirers.

Get Patents on Words

Patents have been granted the Permutit Company, New York City, covering several words used in connection with the company's trademark. The words "permutize," "permutized," "zerowater" and "zerohardness" may be used only in referring to the Permutit Company.

First Issue of Pan-American Record

The initial issue of the *Pan-American Record*, the new house organ of the Pan-American Petroleum & Transport Company, was published this month. The issue, which is well illustrated, contains a history of the company and its subsidiaries, as well as news of the activities of the organization.

Business Notes

G. S. Green Company, New York City, will hereafter carry a complete line of the products of the Dobbie Foundry & Machine Company and act as that company's sales representative in the territory formerly handled directly from the factory.

H. Gries has been made sales manager of the new export department of the Lynchburg Foundry Company. His office is at 90 Wall Street, New York City.

Royal C. Wise, sales engineer and specialist in pumping machinery, Chicago, has removed his office to the Monadnock Block.

The Imperial Brass Manufacturing Company, Chicago, is about to start construction on an addition to its plant which will double the present space.

The Federal Motor Truck Company of Detroit recently held a conference at Cedar Point, Ohio, at which 150 of the company's representatives were present.